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- The Smart User's Guide to Modems
- Free Program to Fine-tune
CONFIG.SYS on the Fly



VOLUME 7 NUMBER 20
NOVEMBER 29, 1988

Mainframes On Tap

The Best Links
To Mainframes:
PC Labs Tests
Network
Gateways



- 15 New 386s Enter the Fast Lane at 20 MHz
- WordPerfect 5.0 Surges Ahead (But It's Not Desktop Publishing)

Plus 6 Hand Scanners for Text or Graphics and
11 Affordable MIDI Programs



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0 71466 02391 3

What you've been doing.



On your 286,
you've been making any task look complicated.



On your 386,
it hasn't been incredibly exciting having all that power.

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You'd expect a program this powerful to require a more powerful machine. But we consistently create software that makes

Stop playing with
ancient instruments.
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a simple point and click
with the Microsoft Mouse.

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With Windows/286,
you could have been seeing things much more clearly.



With Windows/386,
you could have been seeing a lot more things much more clearly.

the best use of your present hardware.

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Vincent Flanders
Access 88

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VOLUME

E 7 NUMBER 30

WHAT'S NEW

Time is money, especially on a mainframe computer. And when a 3270 mainframe was needed for benchmark testing LAN gateways, the subject of our cover story, something even more valuable was called for: dedication. Plus a lot of coffee. Maintaining a controlled environment on a 3270 mainframe, after all, was possible only for someone working after office hours—7 P.M. to 6 A.M., to be exact, when the mainframe was not otherwise occupied. That someone turned out to be *PC Magazine's* LAN Labs project leader Randol Tigrett.

Randy, for his part, is still adjusting his body clock from the 16 straight nights he spent at Harris Testing Facility in Melbourne, Florida. He did have company—vendors' representatives visited each night to offer assistance and help avoid expensive trial and error. But sometimes only a good night's sleep will do the trick.

Workgroup systems editor Frank J. Derfler, Jr.'s two-part story is the result of PC LAN Labs' efforts, and we think it will prompt further discussion about just how essential PC-to-mainframe links have become to the future of any rising company.

Another topic for discussion concerns word processing—in particular, Version 5.0 of *WordPerfect*. Author Dean Hannoteau takes on the question of how closely this stoic darling of word processors is approaching the graphics and font-management capabilities of popular desktop publishing packages. He examines how *WordPerfect* expects to inch out even rival *Microsoft Word* in this fast-moving war of the words.

Fast software needs fast computers. But for users demanding the most megahertz for their money, the cost difference between a 20-MHz and a 25-MHz 80386-based machine may be too great to warrant the fastest money can buy. Contributing editor Winn L. Rosch leads *PC Maga-*



Workgroup systems editor Frank Derfler and Randol Tigrett begin a hard day's night.

zine's look at the newest 20-MHz machines—and don't miss contributing editor Charles Petzold's overview of misconceptions about OS/2 compatibility that can make all the difference in a purchase.

Technology can often be intimidating, and modems are no exception. This issue's PC Lab Notes takes a fresh look at modems and explains in clear, easy-to-understand terms exactly what a modem is and how it can increase your productivity. Power users will find it an indispensable reference of modem terms and commands. And end your boot-up headaches with this issue's utility, CONFIG.CTL, a landmark program that gives you full editing control over your CONFIG.SYS file at boot-up. No more editing and renaming files: just point, shoot, boot!

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*Fits Canon SX and Ricoh 4150 engines.

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COVER STORY

Building Workgroup Solutions: LAN Gateways, Part 1

Frank J. Derfler, Jr. / IRMA lets your PC double as an IBM 3270 terminal—but requires a dedicated connection for each machine. In this first of a two-part series, PC Labs tests the Harris and Banyan local area networks that access a mainframe through a single link, the LAN gateway 92

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The Banyan CNS as a Gateway into the IBM 3270 Architecture

The Banyan CNS provides remote access to a mainframe and a 3270 client. Here it is shown as a gateway into an IBM 3270 system.

WORD PROCESSING

WordPerfect on the Move
Dean Hannote / It isn't desktop publishing, despite the addition of bit-mapped graphics support, on-line macro editing, and some of the most versatile font management ever offered by a character-based program. But *WordPerfect* 5.0 does build on past achievements to bring word processing closer than ever to the elusive DTP ideal. 117

Good and Fast: Fifteen 386s Push the Performance Standard to 20 MHz

Winn L. Rosch / Once the fastest PCs you could buy, 20-MHz 80386-based computers now promise to become the most popular high-performance machines on the market. Check out the latest from companies like AST, Dell, and Everex, and see why the "troublous twenties" are meeting little resistance in today's fast lane 139

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Roberto Brosan

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is expanded in WP 5.0 to include

and extra large

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mathematical and have a shadow

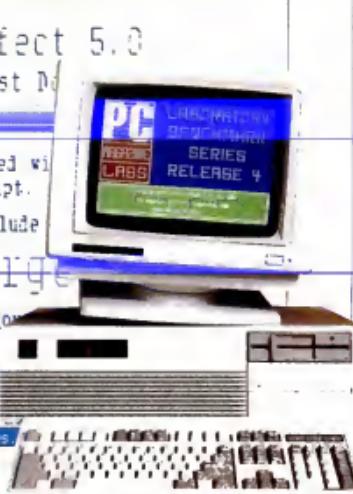
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100% 2 200% 3 Full Page 4 Facing Pages

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Banyan's complete LAN with gateway services to an IBM 3270 system, page 92.



The Dell System 310 uses disk caching to approach the zero-wait-state limit. page 139.



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MapInfo: A bird's-eye view of U.S. city streets, First Looks, page 48.

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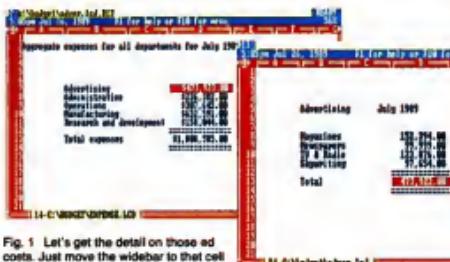


Fig. 1 Let's get the detail on those ad costs. Just move the widebar to that cell and press one key (Grey +).

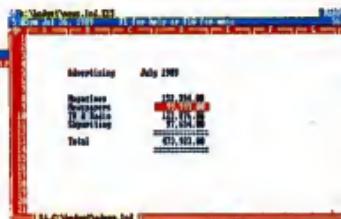


Fig. 2 Here we are, instantly. Notice the lower left corner showing we're on level 2. You can go down or up.

Fig. 3 We want more detail, so let's go to Newspapers. Just press the Grey+key.



Fig. 4 Now, instantly we are on level 3. Each level is a different spreadsheet. You could now move to the New York Times and see the detail on that figure. There is no limit to the levels you can go. Move right down to transaction level if you like.

What Makes Lucid 3-D So Special

In the screen examples you can see Lucid is really three dimensional. Any cell of the spreadsheet can contain a complete other spreadsheet that you can access with a single keystroke. It is as simple as the pictures show. And you don't have to write formulas to do that.

All you do is go look at the other file, navigating through easy point and shoot directories. When you come back up (with one key) the link is made automatically for you.

Everything about Lucid works that way. Users say "It is so intuitive that I really don't need a manual." That's because we use something we call a visual command menu. Jim Seymour, the noted PC columnist, talking about Lucid in a recent article said that, "If there ever was an interface idea so good it ought to be stolen and widely used, this is it."

What he was talking about is a new menu approach that follows a simple design concept: it is easier to recognize than it is to remember. As choices are made on a menu that take you to lower levels you always can see exactly where you came from and where you are going. The complete menu path is always visible. You cannot get lost several levels down. This means you never have to remember a command, you just flow right to it.

Plus, no matter where you are on a menu or what you are doing, just press function key F1, and you will get a help screen specific to that command or action. Or if you want to know about any subject you can pop up an index of over 600 topics and select the one you want.

Notepad Behind Every Cell

Another 3-D feature is that any cell can also contain a multiple page note that you instantly access with a single keystroke. You can write notes, memos or letters that relate to your work, save them as individual files and even print them separately or with your spreadsheet.

"I've been calling it an 'Everyman's Spreadsheet', and I think that's how the market will position it. It's much more than an inexpensive alternative to 1-2-3."

Jim Seymour, Columnist, PC Magazine, PC Week

Speed

Lucid 3-D™ is truly revolutionary. It is fast, fast, fast! It is incredibly quick in performing calculations because it doesn't recalculate every cell every time you insert an entry. Instead, it only recalculates the specific cells that are affected by your change. This is called minimal recalc. Lucid also has a remarkable innovation called background recalc in which you are given control of the cursor the moment calculations affecting your viewing screen are completed. Other calculations

you don't see continue on in the background during the next commands. The end result of this powerful combination is you rarely wait for a recalculation with Lucid. You find out what instantaneous is all about.

Lucid Learns

Lucid 3-D™ also lets you teach it in any combinations of keystrokes so that involved sequences can be done with single keys. Plus more than just remembering keystrokes. Lucid allows you to create Macros with loops, procedures and conditional branching amazingly all done automatically with simple menus. You can create your own menus that show the new features you have taught it. Another great feature is you can make your custom menus work like Lucid where one choice can take you

plete other spreadsheet with a single key.



Fig. 5 Of course, Lucid does multiple windows. Notice, you can simultaneously open windows in different directories, different drives, even down as many 3-D levels as you like. No one else can do that.

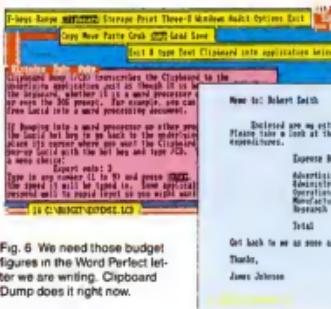
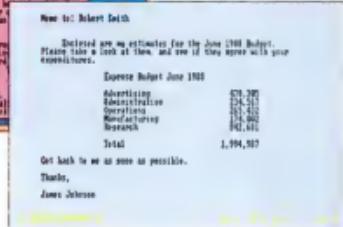


Fig. 6 We need those budget figures in the Word Perfect letter we are writing. Clipboard Dump does it right now.

Fig. 7 (Below) Here it is right in Word Perfect (or any word processor) just like you typed it. You can go the other way just as easily.



down a level to a whole new set of choices. What's nice is that they will work from one spreadsheet to another.

Mouseability

Lucid 3-D™ was designed for both keyboard enthusiasts and mouse lovers alike. You can take your pick. Designed around the mouse from the ground up, the interface is smooth and natural. You select files to load from directory lists. Everything is point and click. What's more, any Lucid 3-D™ menu selection can be "moused" and the response time is "right now" instead of the sluggish "a little bit behind you" feel of add-on mouse menu systems like those you've seen with I-2-3.

A window pops up with a library of function names you can page through with the mouse. Select, click and it's in the formula with no typing required. You even have a label window that you can fill (from the keyboard) with favorite labels and names so that you can insert them later with the mouse. There's even a pop-up calculator to insert numbers so you don't have to go to the keyboard very often.

It really permits that feeling of becoming one with your work. Lucid 3-D™ has windows of user defined range names as well as the macros named by the user that can be selected just by pointing and clicking. Icons that are

easy to grab with the mouse let you resize and move the spreadsheet window with the ease you would expect. Plus you can go anywhere on the sheet by moving the mouse and clicking on the spreadsheet borders. And remember, Lucid is designed so that any of those features are done with or without the mouse easily and quickly.

Audit

When you are staking a big decision on information gained from a spreadsheet you need to be certain that you have made no mistakes. Lucid 3-D™ offers five audit displays and printouts.

Even if you don't plan to abandon I-2-3, Lucid makes sense. Files are

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LETTERS TO PC MAGAZINE

286 FIREPOWER

The 80286 runs DOS and OS/2 software faster than the 80386 or 80386SX when both are running at the same clock speed.

Your benchmark tests show that the Dell System 220 is 35 percent faster than the Compaq Deskpro 386s in the 80286 Instruction Mix test, while it runs at only a 25 percent faster clock speed ("Less Is More," page 93, *PC Magazine*, August 1988). The Dell is also less than half the price of the Compaq.

There are only a handful of DOS applications that take advantage of 386 features, and even these are outperformed by their OS/2 counterparts running on a 286. With ever-higher clock speeds and inherent cost advantages, the 80286 and 286 platforms will continue to dominate the PC marketplace.

Glen Burchers
Austin, Texas

Compaq prices, including the Deskpro 386S, are usually discounted, which puts the Dell and Compaq prices at about the same level. More important, a 286 just can't keep up with the 386's ability to run multiple DOS programs and to extend DOS beyond its current memory limits.

—Ed.

PLEASING TO THE EYE

However snappy your 3-D graphs may look, they actually obscure data and make it harder, not easier, for readers to extract information. Your consistent practice of presenting the same data in both graph and

tabular forms appears to confirm that even you realize the error of your ways. So why give us sophistries when we take you to task for it?

Robert Long
Housatonic, Massachusetts

RIGHT ON TIME

I read with great amusement Jim Seymour's incisive and insightful column on the computer industry's delivery-date debacle ("Software Delays: Truth or Consequences," *PC Magazine*, June 28, 1988). It is all too appropriate that in the next issue, Lotus Development Corp. should devote two full pages to announcing a mystery product, perhaps the ultimate in vaporware.

Well done, Mr. Seymour!

Richard Goldman
Toronto, Ontario
Canada

ALTERNATIVE LANGUAGES

I enjoyed your survey on C compilers and interpreters ("The C Mystique" and "Compiling the Facts on C," *PC Maga-*



zine, September 13, 1988). When are you going to do the same for BASIC?

Dr. Sidney V. Soanes
Toronto, Ontario
Canada

PC Magazine plans to review BASIC in March 1989.—Ed.

Let the professional software developers have C ("Compiling the Facts on C"). Turbo Pascal 4.0 has quickly, and without much fanfare, become the language of choice for a large number of us.

Pat Anderson
Fall City, Washington

A QUICK LESSON

You are making a mess of Latin-derived plural nouns. An otherwise good article ("Removable Mass Storage: You Can Take It With You," *PC Magazine*, September 13, 1988)

used the expression *media* dozens of times as if the writers thought it to be a singular word. The singular form is *medium*. A flexible disk is a recording *medium*; a hard disk is a recording *medium*, etc. Collectively, they are recording *media*.

You occasionally do the same thing with the word *criterion*. The singular form is *criterion*.

Thomas H. Ledford
Baton Rouge, Louisiana

*That's an excellent point. The usual bone of contention is the use of the word *data* as a singular, which we cheerfully endorse. Since we last debated the question ("From the Editor's Screen," April 30, 1985), Webster's Ninth New Collegiate Dictionary has appeared on the scene, agreeing that this usage is now well established, "although it is still occasionally marked*



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- 386 - Track yr portfolio, get weekly reports w/Mutual Fund May.
- 388 - Track yr portfolio, get weekly reports w/Mutual Fund May.

EDUCATION

- 186 - It's patient DOS tutor, DOS 3.0 interactive DOS Tutor.
- 191 - Learn music, US states w/PC-Quizzer. Sign lang demo!
- 228 - Build dazzling typing speed practice w/PC-Fastype. *
- 267 - Graphic mathematical puzzle game makes learning fun.
- 368 - It's simple to use, average student grades w/GradeIt!.
- 376 - Teachers & students can summarize grade w/GradeIt!.
- 384 - (2 disks) X1 See graphic math for HS & college students.

GRAPHICS

- 58 - Display hi-res 3-D molecular structures w/Chem3D EGA.
- 145 - (2 disks) Paint, draw w/Fingerpaint, design w/Altares, etc.
- 210 - (2 disks) Create advanced 3D designs! 640K, hrd disk. *
- 285 - (3 disks) Produce 3-D images w/Surfsoft graphics.
- 362 - (2 disks) Edit graphics, colors w/vGACad! VGA.

GAMES

- 15 - 8-bitermen game tests knowledge of Bible figures/events.
- 23 - Star Trek, Othello2 board game, artillery bombing EGA.
- 28 - Play Backgammon, or Worlplay [like wheel of fortune!]
- 64 - Thrill solitaire card games, Spider Klondike, Camelot! *
- 121 - Quebec, Prinzipia, Centipede, Hopper (if Frogger), move! *
- 151 - Hack plus you! A bush dog in a wild adventure! (if Rogue!)
- 176 - Destroy enemies w/Shink, conquer the world in Risk. *
- 215 - Solve, create own word puzzles w/Phrase Cross!
- 289 - (3) Pacman, Kong, Spacewar, ABM (missile cmd). *
- 309 - Blockstack (you set rules), Anchorman, OB, impulse war!
- 321 - Star Trek, the original Cobeless Claves Adventure, more.
- 365 - (5 disks) Create your own golf adventure games. 384K.
- 372 - Pinball, Othello, Dragons, Sowpits (if you), battleship. *

UTILITIES

- 130 - Packaged print files for print spooling, banners, fonts, etc.
- 141 - Print wide documents/printers w/On-Side!
- 214 - (2 disks) Search for addresses w/Zip-Phone cross ref.
- 250 - Work around DOS w/Easy Access hard disk menu sys.
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MISCELLANEOUS

- 31 - Movie Database lists 4,000+ films available on videotape.
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- 74 - Troubleshoot your landline? Learn your legal rights aginst.
- 85 - Add windows & give your Basic progs a professional look.
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VIEWPOINTS

LETTERS

with a disapproving 'sic.'"

Using media as a singular form is harder to justify, but not a new idea; it is sanctioned by 65 years of exposure in the realm of advertising (admittedly in a somewhat different sense). If we've gone too far in our efforts at language reform, our main concern was clarity. Computer users really do speak about the "media surface." Would you immediately understand what is meant by "medium surface," or "medium wear," or "medium life?"

As for criteria, we apologize. If you found that word used as a singular, we must have goofed.—Ed.

IMAGE BACKUP TAKES THE LEAD

Let's be clear about the relative merits of file-by-file and image backups ("Image vs. File-by-File: Two Paths to Tape Backup," sidebar to "Hardware Standbys: PS/2 Tape Drives," *PC Magazine*, May 31, 1988; Letters, September 13, 1988). File-by-file restore from an image backup allows the user to restore any list of files without having to restore the whole disk. File-by-file backup is really only intended for use in transferring a few files from one machine to another on tape. Image backup is superior when archiving a disk and restoring a moderate-to-large number of files.



John E. Adam
Fayetteville, Arkansas

FAST-LANE FINANCING

Although owning a Ferrari would be nice, most of us find it hard to justify the cost. Similarly, until VGA lowers its price to EGA levels ("Making Way for VGA," *PC Magazine*, May 31, 1988, and Letters, September 13, 1988), it is hard to justify wasting money buying VGA if EGA can do the job.

Robert Zimmerman
Reston, Virginia

OUT OF LINE OR ON THE LEVEL?

It was refreshing to read Jim Seymour's positive words about IBM ("PS/2: Reliability Counts," *PC Magazine*, Septem-

ber 13, 1988). Too much negative attention is given to IBM's attempts to improve established standards. It is because of IBM that we have the standards we enjoy today.

I, for one, fully appreciate the newest line of IBM computers, with their current benefits and future potential.

Mike L. Gilliam
Alhambra, California

After 4 hours of trying to install DOS 4.0.1 I finally got it running, with extended memory only. Instead of 1MB memory, I got only 360K of standard memory, which was not enough to run *Ventura Publisher*.

There was no telephone number in the DOS manual. In my opinion, the manual appears to be written so that anyone with less than an advanced degree in computer science will need support and a few dozen numbers to call.

The next time I consider purchasing a personal computer, IBM will get the same consideration they are providing their customers—zilch.

Jess McIlvain
Bethesda, Maryland

KUDOS TO DVORAK

PC Magazine is sensitive to what is important to its readers and has a writing staff who provide information with clarity and superb style. I particularly enjoy John C. Dvorak's informative, incisive, and witty presentation of his uncanny insight into personal computing.

Richard A. Stalls
Washington, D.C.

TAKING CHARGE WITH A PC

In response to Bill Machrone's column "Getting CEOs to Use PCs" (*PC Magazine*, September 13, 1988), I think many CEOs have not taken to using PCs because they have no compelling reason to do so. The CEO's job is to make strategic, rather than tactical, decisions. Most of the information a CEO requires is located outside of the organization.

In order for CEOs to use PCs, the PC must be an integral part of an orderly system for collecting and manipulating the tons of messy, qualitative, external data with which they have to deal.

Keith Hamilton
Springfield, Illinois

THE BUS STOPS HERE!

CompuStar: PS/2 and PC/AT Compatibility.

Ask any computer expert about what type of system you should buy nowadays and you'll likely get a "pass the bus" response. Something like — "Well, uh, the PC/AT* bus is your best buy but, then again, the new PS/2* bus may become the next industry standard." Great advice, right? If trying to decide on a microprocessor weren't tough enough, now you're expected to pick a bus, too.

RELAX, NOW THERE'S COMPUSTAR.

The all new CompuStar from Wells American not only lets you interchange microprocessors, you can also mix and match buses — a PC/AT bus, a PS/2 bus or... both. As your computing needs change, simply snap in a new processor or add an extra bus. You'll never again have to worry about buying the wrong computer system!

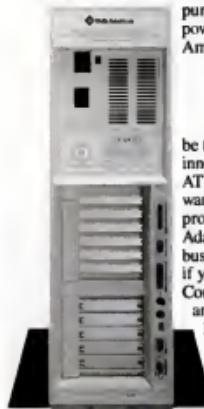
FOUR COMPLETE SYSTEMS IN ONE.

The CompuStar can be configured with any of four microprocessors — an 8086, an 80286, an 80386SX, or an 80386. The processor and up to 16 megabytes of user memory have all been combined, using the latest VLSI technology, on a single, plug-in CPU module. Plus, any time during the first year of ownership, CompuStar users can "trade-in" the CPU module they initially selected toward the purchase of any of the other more powerful modules. Nobody but Wells American gives you this kind of value.

A CONVERTIBLE BUS? YOU'RE KIDDING!

No, we're not. In fact, it may well be the most practical microcomputer innovation ever. Say you've selected an AT compatible CompuStar and later want to add PS/2 compatibility. No problem! Snap in a PS/2 Bus and Adapter Module and you can use both buses in the same system. Likewise, if you've selected a PS/2 compatible CompuStar and decide you want to add an AT bus, just snap in an AT Bus Module. Depending on configuration, the CompuStar can have up to 13 bus expansion slots — all AT slots, all PS/2 slots or a "split-bus" of AT and PS/2 slots. No matter which bus becomes the

next industry "standard," you'll have peace of mind knowing your investment in a CompuStar will be protected.



The CompuStar is also easily expanded. That's because there are seven CompuStar disk/tape compartments — six accessible from the front and an additional full-height bay inside. All this in a sleek, compact tower design that will leave more room on your desktop than any of the so-called "desktop" models.

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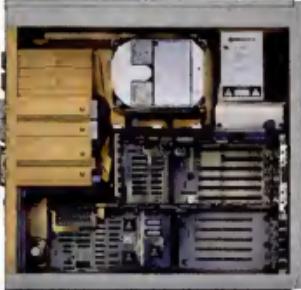
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Think all this technology sounds expensive? It's not. CompuStar 20MHz 80286 systems start as low as \$1995. There are also inexpensive 8086 and powerhouse 25MHz 80386 systems available. Plus,

there is a wide variety of CompuStar display, tape and disk options including a one gigabyte erasable optical disk. You can choose a factory pre-configured CompuStar or custom design one yourself.

Just unlock the front panel and literally "snap-in" a bus, CPU, memory or disk module in a matter of seconds. It's system flexibility never before available...at any price.

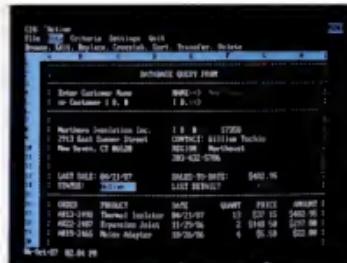
While one of our competitors (we won't mention any names) threatens you with "missing the bus," most simply pass the bus. Our new CompuStar, however, eliminates the bus problem altogether. Not to mention the processor problem. Even the expansion problem. Prove it to yourself. Call today about our 31-day trial offer. Oh, and by the way, the next time anyone asks, tell 'em you know where the bus stops.



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CompuStar 80286 system (\$1995) includes an AT Bus Module, built-in VGA/EGA display adapter, one diskette drive with controller, two serial ports, parallele mouse port, keyboard and 220 watt power supply.



dBASE Power for 1-2-3

Last year we met a crazy programmer who said he could build a database with the power and capacity of dBASE and put it *inside* 1-2-3. Well, he works for us now, and if you know anything about database programs, his baby is going to knock your socks off.

Introducing @BASE, a full-feature relational database add-in for 1-2-3. Now anyone who knows how to use 1-2-3 is an instant database wizard because @BASE turns 1-2-3 into a powerful "front-end" for database applications. *It's as easy as 1-2-3.*

Huge capacity

If you've every tried to use 1-2-3 as a database manager, there's a good chance you've run out of memory. That's because 1-2-3 stores data in the worksheet. @BASE stores data on disk where record capacity is virtually unlimited. You'll never run out of memory again.

Brains and brawn

@BASE compares with powerful stand-alone database programs like dBASE or R-BASE,[®] but it operates in concert with 1-2-3. You get the best of both worlds. 1-2-3 gives you tools for data analysis. @BASE gives you big data capacity. Brains and brawn. It's a nice combination.

In minutes you can build a worksheet with dynamic links to the database on disk. (The worksheet might present a sales recap by region.) Next month, for up-to-date results, simply

load and recalc the worksheet. Fresh database information is automatically linked from disk.

Industry-standard file format

@BASE uses exactly the same file format as dBASE III and dBASE III Plus. *dBASE is not required to use @BASE.* But if you have standardized on dBASE, @BASE fits right in. @BASE reads and writes dBASE files directly. No conversion is necessary.

At less than a third the cost of dBASE, you may decide to use @BASE instead of dBASE throughout your organization whenever users need easy access to dBASE information.

Serious Performance

@BASE beats dBASE III Plus in benchmark tests.* @BASE is up to 3.7 times faster!

	dBASE III Plus	@BASE
Locate record	12 sec	12 sec
Pack database	7.1 min	1.9 min
Sort database	10.8 min	4.5 min

*Test with 4,000 records, 34 fields per record

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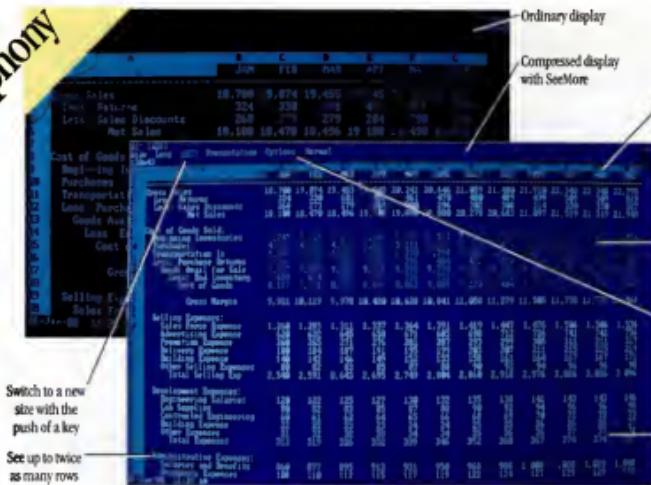
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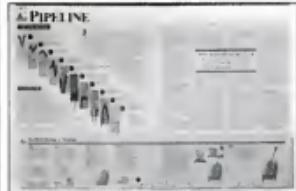
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■ LETTERS

BIG-STICK ECONOMICS

Jonathan Matzkin has outlined a classic example of the damage done by government intervention in trade (*Pipeline, PC Magazine*, September 13, 1988).



Magazine, September 13, 1988).

Our government acted to increase the price of RAM chips and to restrict their manufacture for the purpose of protecting domestic interests. The "trade" agreements benefited the American RAM manufacturers—at the expense of the American and Japanese RAM chip consumer.

Walter J. Turberville III
Phoenix, Arizona

TIME-SAVING TRAP

Richard Hale Shaw's recommendation in his Productivity column ("Writing Optimal C, Part 2" (*PC Lab Notes, PC Magazine*, September 13, 1988) to use pointers rather than indices is counterproductive, because the time required to increment the additional variable often outweighs the time saved.

Robert Sacks
Long Island City, New York

A DANGEROUS HALF-TRUTH

John C. Dvorak is a typical example of the shallow IBM PC/MS-DOS mentality that used to permeate the microcomputer community ("The Ugly Reality: Unix Is In Your Future," *PC Magazine*, August 1988).

There is no evidence that the majority of PC users were required to, willing to, or even had to "learn" MS-DOS, Apple Finder, and so forth in order to effectively use their machines. Similarly, one can proficiently use Unix-based applications without regard for the complexities of the underlying operating system.

Wendell Anderson
Hamilton, Bermuda

ACCOUNTING FOR THE FULL COST

I wholeheartedly applaud *PC Magazine* for recognizing the emergence of call accounting software ("Call Accounting: Tracking PBX Costs," *PC Magazine*, August 1988).

Contrary to the statement in the article, however, the sampling did not represent a true "cross section" of the PC call-accounting market. The products that you reviewed had costs ranging from \$3,000 to \$12,500. This range neglects the full-featured systems priced below \$1,000, as well as the high-end \$20,000+ products that offer users more facilities management features.

Diane M. Kamionka
Cincinnati, Ohio

CORRECTIONS/AMPLIFICATIONS

The correct telephone number for Cypress Systems Inc. is (213) 207-3938 (First Looks, page 59, *PC Magazine*, September 27, 1988).

The NOP benchmark-test result published for the Toshiba T3200 laptop ("Take It or Leave It: Portables with Desktop Power," *PC Magazine*, October 11, 1988) was incorrect. The actual result for the Toshiba T3200 was 2.80 seconds, not 2.08. The corrected number places the Toshiba on a par with the Compaq Portable III, the Zenith SupersPort 286, and the Mitsubishi MP286L.

The Dolch P.A.C. 286-16, which posted a time of 2.11 seconds, was the fastest 80286-based portable machine on the NOP benchmark test. *PC Magazine* regrets the error.

The correct model number of the C. Itoh Triprinter reviewed in this year's printer issue ("Dot Matrix Printers: The Market Matures," *PC Magazine*, October 31, 1988) is the 4000, not the 5000 as was stated in the review.

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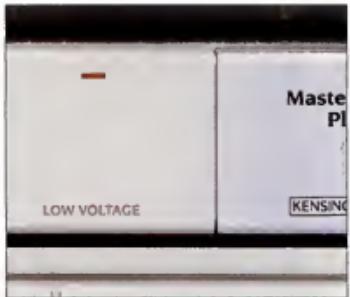
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■ JOE DESPOSITO

PC ADVISOR

Advice on how to solve an EMS dilemma, where to find the full text of PC Magazine in electronic form, and assistance in choosing the right backup power supply.

LIM EMS 4.0 TO THE RESCUE

I may be reaching for "pie in the sky," but are there any memory expansion boards available that can emulate (through hardware and/or software methods) all three memory specifications—namely, extended (AT type), expanded (Lotus/Intel/Microsoft EMS), and enhanced expanded (AST/Quadram/Ashlon-Tate EEMS)? My immediate need is for increased memory to use within *DESQview* (EEMS required). However, I do not wish to lock myself out from the other options for future system upgrades.

Paul A. Kalinsky
Kensel, Washington

The dilemma you write about was resolved when Lotus, Intel, and Microsoft announced their expanded memory specification, LIM EMS 4.0. Some of its capabilities, such as multitasking and program code execution in expanded memory, are equivalent to capabilities originally developed by AST for its enhanced expanded memory specification (EEMS).

If you haven't purchased a memory board yet, I suggest you read Winn L. Rosch's feature "Leveraging RAM with LIM 4.0," which appeared in the October 11, 1988, issue of PC Magazine. For anyone who has one of the older EMS 3.2 or EEMS boards, be advised that LIM EMS 4.0 can run on them if you acquire new device drivers. Also, applications written to EMS 3.2 are upwardly compatible with EMS 4.0.

In general, memory expansion boards provide both extended and expanded mem-

ory. You configure a board for extended memory, expanded memory, or both by setting switches or using a software setup program.

PC MAGAZINE ON COMPACT DISK

We are subscribers who are interested in computerized information-retrieval on articles in your magazine. Ideally, we would like either a topic-oriented and/or a "keyword in context" type of search on articles, preferably resulting in the text/graphics itself, or (second choice) a reference from which to look it up.

Lawrence M. Bloom
Tampa, Florida

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■ Computer Library contains the full text of *PC Magazine* and nine other computer publications, as well as abstracts from others.

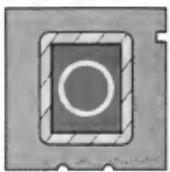
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You can find a products database and an articles database under the Utilities menu of PC MagNet. The databases are available in three formats: comma-delimited ASCII, fixed-field ASCII, and dBASE III. A detailed explanation of PC MagNet and how to join is in the May 31, 1988, issue of PC Magazine (First Looks, page 46). Future plans for PC MagNet include an on-line version of Computer Library.

UPS, SPS, AND NOW IPS

I have an IBM PS/2 Model 80 with an 8513 color monitor, and I want protection from surges and blackouts. I am so confused with the amps, volts, watts, Hz, VA, and so forth that are required for choosing the right standby or uninterruptible power



■ PC ADVISOR

supply. Could you help me choose the right equipment? Also, what do you recommend, a standby or an uninterruptible power supply?

Carlos J. Nazario
Bayamon, Puerto Rico

PC Magazine did a roundup of 25 backup power supplies in its September 16, 1986, issue ("Backup Power: When the Juice Stops Flowing"). In that article Winn L. Rosch gives a few simple guidelines for choosing a backup system: "The backup power system must have enough capacity, measured in watts or volt-amperes (VA), to power both your PC and its monitor. Backup time is less important. A few minutes of backup power should be sufficient; it's just enough time to realize what happened, evaluate the situation, and shut down your computer systematically, saving your data . . . The exact power demand of a computer depends on the num-

ber and kind of expansion boards and disk drives installed in it." About 400 VA is a safe figure for an AT or 386 system.

A UPS operates continuously from battery power, using the line voltage to keep its batteries charged. An SPS, on the other hand, switches to a battery supply when it senses a loss of power. For protecting your computer against spikes and surges on the power line, a UPS is better.

At the time, the SPS Editor's Choice was the DataSaver 400 from Cuesta Systems (3440 Roberto Ct., San Luis Obispo, CA 93401; (805) 541-4160), which has a suggested list price of \$695. Among the UPS units tested, the MS-300 (formerly Micro-250) from Imunec (5000 Highlands Pkwy., #150, Smyrna, GA 30082; (404) 434-3493) got the Editor's Choice award. The MS-300 retails for \$1,050.

Not to confuse the issue, Elgar (9250 Brown Deer Rd., San Diego, CA 92121; (619) 450-0085) has a new product in this

category called an IPS (for intelligent power supply). The IPS 400+600 provides 400 watts of battery backup and an additional 600 watts of conditioned power for auxiliary equipment. Internal spike and noise protection circuitry as well as five output receptacles come standard with the unit. "Intelligence" is packaged in the form of Elgar's Failsafe software program. When power fails, Failsafe has the ability to automatically save data and exit the application program. When power is restored, Failsafe can reboot the system and continue the application that was interrupted. The suggested retail price of the IPS 400+600 is \$745; cost of the Failsafe software and cable is \$195 (\$245 for the LAN version).

ASK THE ADVISOR

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Save Time: Run tedious chores on your remote computer through The Brooklyn Bridge which equips you with dual independent processing power.

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WHITE CRANE SYSTEMS



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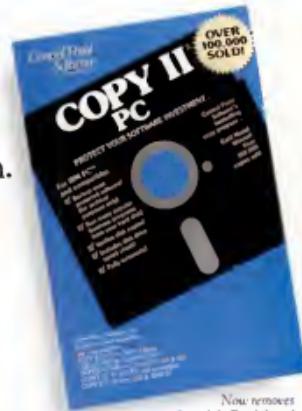
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EVERYBODY

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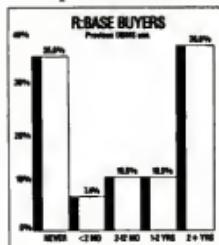
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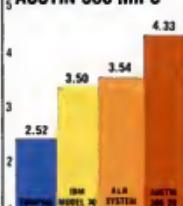


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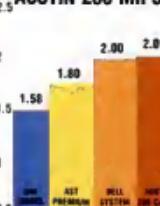
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One surface metal construction	YES	NO	NO	NO	NO	NO
Supports up to 4 MB memory or 16 MB with 32-bit extended memory	YES	NO	NO	NO	NO	NO
2 layer motherboards	YES	NO	NO	NO	NO	NO
ISA and MCA auto-selecting adapter	YES	NO	NO	NO	NO	NO
Build-to-order part	YES	NO	NO	NO	NO	NO
Manufactured model in U.S.A.	YES	NO	NO	NO	NO	NO

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CIRCLE 509 ON READER SERVICE CARD

PC
MAGAZINE

FIRST LOOKS

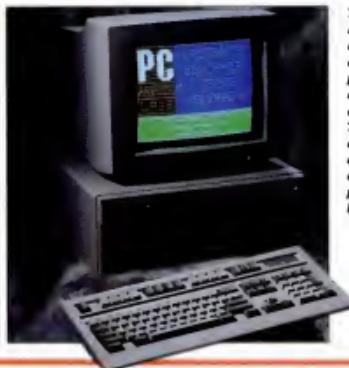
Tandy Ships First MCA Compatible: 5000 MC Features Five MCA Slots

PC HANDS ON

BY WINN L. ROSCH

Not with a bang but with just a little catalog entry does the first Micro Channel-compatible computer enter the PC market. Low-key and unassuming, Tandy's 5000 MC is a powerful competitor to IBM's Model 70.

Compared with more-conventional computers, the \$4,999 Tandy 5000 MC rates as a medium-performance, small-footprint 20-MHz 80386-based PC. To match the fast 80386 of the 5000 MC to its slower 100-nanosecond main memory,



The Tandy 5000 MC ships standard with a full assortment of I/O ports, including a connection for a VGA monitor. Tandy puts the microprocessor and static-RAM controller on a proprietary 32-bit board.

Tandy uses an Intel 82385 cache controller coupled to a 32KB static-RAM cache. A socket is provided for the addition of a 20-MHz 80387 numeric coprocessor.

The physical and electrical arrangement of the 5000 MC marks a notable break with tradition. Tandy puts the prime processing elements—the microprocessor, coprocessor, cache controller, and cache—on a proprietary 32-bit expansion board.

Main memory is also banished from the system board circuitry, using two additional pro-

(continues on page 36)

EISA Takes on IBM's Micro Channel

PC ANALYSIS

BY MARY KATHLEEN FLYNN

Like politics, competing against IBM can make for strange bedfellows. The nine PC compatible makers that recently formed the Extended Industry Standard Architecture consortium usually focus their campaigns on each other. But, in their efforts to wrest the future of the PC industry away from IBM, their common opponent is IBM's 32-bit Micro Channel architecture.

Only hours before IBM introduced its PS/2 Model 30/286, its reentry into the AT-bus market, the EISA consortium announced specifications for its own 32-bit multimastering bus. Dubbed the EISA bus, the new architecture promises to offer the advantages of IBM's MCA

without sacrificing compatibility with the AT, or industry standard, bus.

The consortium members list reads like a Who's Who of compatible-maker heavyweights, featuring Compaq, Hewlett-Packard, Tandy, and Zenith. All the major players in the industry, with the obvious exception of IBM, have announced support for the EISA specification. Those companies include Intel, which is defining the chip level of the EISA specification, and Microsoft, which has announced OS/2 support for EISA machines.

Whether or not this unprecedented show of industry solidarity signals an end to IBM's near-autocratic leadership role is unclear. The full impact of the EISA specification, or lack

thereof, will remain unrealized at least until the first EISA-based machines begin to hit the market toward the end of 1989. All that is certain at this point is that the battle is on, and the stakes are high.

The allure of both the EISA and the MCA lies in their support of multiple bus masters—processors that are incorporated into the design of adapter cards and are capable of temporarily taking control of the bus to transfer data, freeing up the CPU for other tasks. At least in theory, multimastering bus designs will deliver performance unheard of by today's standards.

Neither the MCA nor the EISA bus will offer buyers substantial advantages until OS/2

(continues on page 34)

● EISA vs. MCA: Which Is Better? See Page 35.

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EISA

(continued from page 33)

and its multitasking applications, written to support multi-mastering, come into their own. That means a 2- to 3-year wait.

The EISA consortium's chief gripe against the Micro Channel isn't performance. According to EISA members, it isn't even IBM's 5-percent MCA royalty. What does have the EISA group up in arms is the MCA's incompatibility with the AT. PCs based on the AT bus still account for the fastest-growing segment of the PC market, and the majority of today's applications don't require the performance benefits of multi-mastering. The EISA bus, the so-called Gang of Nine argues, is an "elegant transition," like the 16-bit AT extension bus was for the 8-bit XT. EISA machines, the consortium members point out, will allow buyers who want 386 performance to stick with their AT peripherals while also providing the option of upgrading to bus-mastering peripherals.

Despite their problems with MCA, however, most of the EISA companies say they will provide Micro Channel products if their customers want them. (Compaq says it will not.) After over a year of R&D on the MCA, most of them sound pretty well poised to deliver those products.

The technical merit of the EISA specification itself will surely play some role in determining the bus's success (see related story "EISA vs. MCA: Which Is Better?" page 35), but most of the industry agrees that the two architectures offer roughly the same performance. The question becomes, Which will gain acceptance?

If the number of industry supporters is any indication, the Extended Industry Standard Architecture consortium is doing very well. More than 80 companies have hopped onto the EISA bandwagon.

Board makers, who represent the first level of acceptance, are delighted by the EISA announcement. For them, EISA means the first standard 32-bit bus extension with widespread industry support. Until now, compatible makers such as Compaq, Tandy, and Dell each insisted on its own 32-bit bus extension. And, while MCA gave board makers the hope of a standard, satisfaction over MCA product sales is mixed.

Tecmar, which has announced support for EISA, says that Micro Channel products now account for 20 percent of the company's business. According to Dan Lucarini, Tecmar's director of marketing, the company has shipped 25,000 MCA boards in the last 12 months. IBM, Lucarini adds, is Tecmar's biggest client.

Tandy to Ride All Three Buses

At least one compatible maker plans to offer two product lines, one based on the Micro Channel architecture and one on the Extended Industry Standard Architecture. Tandy recently began shipping its 5000 MC—the only non-IBM MCA machine available today. (See First Looks, page 33 in this issue.) The EISA member also plans to roll out an EISA box, probably in the third quarter of next year.

Tandy's director of marketing, Ed Juge, anticipates the emergence of two markets for the high-performance buses. He defines the Micro Channel market as those Fortune 500 MIS

shops that view PCs as a small piece of a large plan. The EISA bus will be aimed at users who don't want to depend on a single source for hardware and who don't see their PCs as mainframe extensions.

Tandy's Juge cautions, "There's nothing you can do with either [the MCA or the EISA machines] today." But some of IBM's and Tandy's customers are already planning for the future. IBM claims to have shipped 1½ million MCA machines, and Juge reports that early returns on the 5000 MC exceed company expectations. —Mary Kathleen Flynn

1987 PC Market Share: How the EISA Consortium Stacked Up Against IBM

MARKET SHARE

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EISA vs. MCA: Which Is Better?

PC ANALYSIS

BY STEPHEN R. DAVIS
AND KEN A. STROUD

If the acceptance of one standard over another were based on technical considerations alone, the world would be much different place. Factors having little to do with technical excellence often determine which standards survive. Still, the technical merits of the Extended Industry Standard Architecture specification will play a role in the success of the compatible makers' Micro Channel architecture alternative.

The most significant advance of the EISA bus over its AT predecessor is support for up to seven bus masters, allowing addition of as many as six bus-mastering adapters. This multiple bus mastering allows a hard disk controller, for instance, to manage the actual data transfer to and from the disk, leaving the system CPU free for other tasks. AT cards may have CPUs of their own, but they may not compete for access to the bus. The MCA also supports seven bus masters, but in existing PS/2s the motherboard CPU cannot access its own memory while the bus is being controlled by another bus master.

The EISA bus allows bus access to as many as eight Direct Memory Access (DMA) controllers. Single-cycle 32-bit data transfer using the full 32-bit address space delivers an effective burst rate of 33 million bytes per second. This number is reduced slightly for large transmissions by competition with the dynamic memory refresh.

DMA in existing MCA machines runs at a rate of 200 nanoseconds per transfer, yielding a lower DMA rate of 20 megabytes per second. After arbitration is calculated in, the effective rate is closer to 18.7 megabytes per second. This is not a limitation of the MCA bus, however, but of today's hardware designs. An MCA bus

master card could be built capable of transferring data with a slave card at rates of at least 66 megabytes per second.

With multiple processors and DMA chips vying for access to the bus, architectures such as EISA and MCA must include a bus arbitration scheme to guard against conflicts. The EISA bus arbitration is implemented in hardware on the motherboard. This enables designers to know exactly how long it will take their devices to gain access to the bus resources.

The EISA rotates in round-

the DMA channels can be reprogrammed to different priorities at different times during program execution.

The EISA allows the configuration of resources on the bus with jumper switches on the card or via software. Each of the 15 slots on the bus is assigned an address for a 32-bit product identifier. Configuration files supplied by each manufacturer are used by the software to configure and initialize the board. The dedicated I/O address for each slot allows multiple identical cards to run on the EISA bus

bit is reset by the service routine software. Several cards can use the same interrupt, and the service routine can determine which card generated the interrupt via this bit.

The EISA bus is very power generous, specifying 22.5 watts of 5 volts per slot. With 15 slots and an estimated 10 amps for the motherboard, a 400-watt power supply will probably be a minimum. Power usage on the MCA is much more limited. Two amps of 5 volts, 175 milliamps of +12 volts, and 40 milliamps of -12 volts is all that is available per 32-bit slot.

The EISA bus extension has been implemented by adding an additional connector beside the standard AT connectors. While this design retains compatibility with present ATs, it leaves a lot to be desired from an electro-magnetic interference (EMI) standpoint.

Numerous and carefully specified power and ground planes give the MCA excellent EMI characteristics. The only part of the interface that is not shielded is the connector. Layout of the MCA connector signals also shows a superior design. AC ground signals are spaced every four pins on each side of the connector. This layout ensures a low level of signal crosstalk, allowing a higher theoretical data transfer rate.

The EISA boards are the same size as AT boards, some 63 square inches. MCA cards measure about half that size. But, with today's surface-mount technology, card size becomes a secondary issue.

The bottom line? On a performance level, EISA-based machines and their bus-mastering adapter cards should compare favorably with today's PS/2s. From a technical standpoint, however, the EISA specification falls short of the MCA, primarily because of its growth limitations. The EISA features that allow compatibility with the AT bus also limit performance gains over the current specification. The MCA's cleaner and more flexible design, on the other hand, will allow IBM to design higher-performance MCA implementations into future PS/2s.



EISA vs. Micro Channel: Functions and Features

	AT	EISA	MCA
AT-compatible	●	●	○
Expansion board size	63 sq. in.	63 sq. in.	36 sq. in.
Auto system configuration	○	Optional	●
Multiple bus masters	○	●	●
Arbitration method	Centralized	Centralized	Distributed
Shared interrupt support	○	●	●
Interrupt trigger	Edge	Level or edge	Level
Bus speed	8 MHz	8 MHz	10 MHz
Data path width	8, 16 bits	16, 32 bits	16, 32 bits
Address path width	24 bits	32 bits	24, 32 bits
Standard data transfer rate	4MB/second	16.7MB/second	10MB/second
Maximum data transfer rate	5.5MB/second	33MB/second	20MB/second
DMA support	8-, 16-bit	8-, 16-, 32-bit	8-, 16-bit
Maximum DMA transfer rate	2MB/second	33MB/second	5MB/second

●—Yes

○—No

robin style between the three types of bus requesters—bus masters, DMA controllers, and the Memory Refresh Controller. Arbitration among the DMA channels is on a strict priority basis, with the highest priority request getting the bus. Arbitration among bus masters is on a round-robin basis with one exception—in order to ensure compatibility with the AT bus, the system CPU always receives the control it requests.

The MCA implements a distributed local arbitration that is a much more flexible and more software-configured system. Each card must decode the arbitration signals and control the bus accordingly. Even some of

without I/O conflicts.

Software board configuration is not optional on the MCA. Critical setup parameters are stored in battery-backed RAM. Manufacturers are assigned unique identification numbers for each card by IBM so that cards may be uniquely identified at power-up. The MCA provides a means of accessing several identical cards through software configuration at power-up.

The EISA bus can support level or edge-triggered interrupts, thus supplying a mechanism for shared interrupts. MCA cards have a bit in their POS register that is set when the card generates an interrupt. This

Tandy 5000 MC

(continued from page 33)

prietary connectors. Each of the two memory boards holds eight Single In-line Memory Modules (SIMMs), either of 256K or 1MB rating. All SIMMs must be the same in a single system, permitting system capacities of 2, 4, 8, or 16MB. One board with 2MB is standard.

The odd, almost chevron-shaped system board holds only expansion slots and support circuitry. None of the notorious Micro Channel VLSI chip sets is used. Overall, construction was very good, some of the best work that Tandy has done.

Of the eight expansion slots in the system, only five are available for third-party accessories, and all of these are equipped with Micro Channel connectors. Two use the full 32-bit bus, two are plain 16-bit, and one adds the VGA Feature.

In our evaluation machine, one 16-bit slot was filled with an optional Adaptec hard disk controller. The floppy disk control circuitry is built into the system board, along with parallel and serial ports, VGA video, and a mouse port. All connectors fol-

low the PS/2 standard: 25-pin male D-shell for serial, 25-pin female D-shell for parallel, 15-pin high-density D-shell for VGA, and miniature 6-pin DIN for keyboard and mouse.

Mass storage adds refreshing options when compared with the IBM desktop PS/2s. Beneath the two side-by-side 3½-inch drive bays are an over-and-under pair of 5¼-inch half-height bays. Standard equipment puts a 1.44MB high-density 3½-inch floppy disk drive in the top right. The evaluation machine was also equipped with an optional 84MB Rigidyne 3½-inch hard disk. Connectors are provided so that a second floppy disk drive can be either the 3½-inch or 5¼-inch connection scheme.

The 5000 MC is paired with a new Tandy keyboard, which follows the IBM 101-key Advanced layout. This keyboard delivers a good feel coupled with a light, almost too-sensitive touch.

Unlike the IBM PS/2 design, the 5000 MC is not totally free from setup jumpers and DIP switches. Several switches are used for indicating system memory size. Another jumper is

provided to clear the CMOS configuration memory. Otherwise system setup is accomplished using a Reference Diskette that's included with the system.

The important question about the first Micro Channel compatible is, of course, how compatible it is. The 5000 MC falls short of perfection.

The important part of the system—its Micro Channel architecture—worked fine with several memory and multifunction expansion boards. Note, however, that no currently available Micro Channel boards take advantage of the system's bus arbitration. The VGA subsystem of the 5000 MC system board fell short of complete register compatibility, however, scoring abysmally at the level of the last generation of third-party VGA cards.

Our evaluation machine also demonstrated an inability to run the PC Labs extended memory tests, although it was capable of running extended-mode programs like *Microsoft Windows/386*. Tandy attributed this problem to an early version of the system's Phoenix BIOS.

The Tandy 5000 MC is a



FACT FILE

Tandy 5000 MC

Tandy Corp.

1700 One Tandy Center

Fort Worth, TX 76102

(817) 878-4969

List Price: \$4,999 for base system; \$6,499 with 40MB hard disk; \$6,999 with 80MB hard disk.

In Short: A 386 system based on an MCA-compatible bus. Its MCA compatibility is good but not perfect.

CIRCLE 447 ON READER SERVICE CARD

worthy competitor to IBM's 20-MHz Model 70, delivering equal performance and good (but not perfect) compatibility. Its roomier case and extra option of internal 5¼-inch drives make the 5000 MC a better choice for the office in transition between PC bus and Micro Channel architecture standards. Its obscurity will likely be only temporary.

MP



Benchmark Tests: Tandy 5000 MC vs. Compaq Deskpro 386/20e and 20-MHz IBM PS/2 Model 70-121

The Tandy 5000 MC lags behind the Compaq 386/20e and the 20-MHz IBM PS/2 Model 70-121 in hard disk throughput, despite an 18-millisecond random access time. Its processor and memory test performance is comparable to that of the Compaq and superior to that of the IBM.

Performance Times

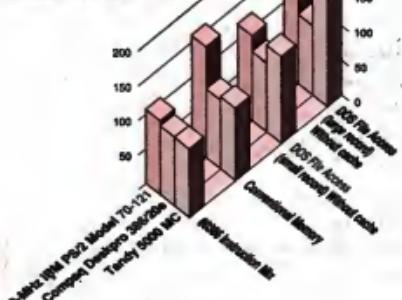
(Times given in seconds)

	80386 Instruction Mix	Conven- tional Memory	DOS File Access (small record) without cache	DOS File Access (large record) without cache
20-MHz IBM PS/2 Model 70-121	3.13	0.81	77.33	8.57
Compaq Deskpro 386/20e	2.91	0.38	62.93	6.92
Tandy 5000 MC	2.90	0.40	79.29	17.97

The 80386 Instruction Mix benchmark test measures the time it takes to execute a selected series of processor-intensive tasks. The test program uses 80386 instruction code. These instructions are a subset of the total processor instruction set.

The Conventional Memory benchmark test measures 256KB of conventional memory and reads it as a series of 64-byte records. Then, 16,384 random records are read into and written from this memory. The result shown is the average of the read and write times.

Relative Times
(Compaq Deskpro 386/20e = 100)



The DOS File Access benchmark test measures the throughput rate of the disk being tested. In this case, throughput times are measured in terms of how long the disk takes to perform common DOS file management functions. File creation, sequential file write, sequential file read, random file write, and random file read—are timed and the results summed.

The test is carried out for two different types of files—small-record files and large-record files—that are used by common PC applications. Files created using small records are typically used by database management programs, and large records are typically used for word processing and spreadsheet files. Loading a DOS program is also simulated by the large-record test.

BASICS

Roman
Helvette
Rockland
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BOOK

Garamet
Basque
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BASICS II

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Include \$5 shipping and handling with all orders. Add \$2.50 for second item and each additional item. All Swifte products carry a 30 day money back guarantee. <small>CHICKS PUBLISHING INTERNATIONAL LTD.</small>		
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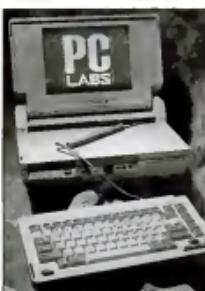
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Compaq's First Laptop Packs VGA Display, Runs 3 Hours on Battery

PC HANDS ON

BY GUS VENDITTO

For years Compaq said it wouldn't sell a laptop until it could build a screen that wasn't shackled with shortcomings—a



screen that worked in poor lighting, could generate decent graphics, and didn't slow down

an otherwise fast machine.

Compaq didn't lie.

The Compaq SLT/286 is the first portable with VGA graphics, and the screen races at world-class speeds. Sixteen shades of gray emulate the VGA color spectrum.

Fluorescent backlighting of the liquid crystal display means you'll never have to squint, even on a dark train. The fluorescent tubes cast a visible outline, and some graphics have tracers, similar to other laptops, but these effects are minimal and don't diminish what is arguably the best laptop display yet.

A 12-MHz Intel CMOS 286 and Connor Peripherals 24-millisecond hard disk are the heart of the machine.

The basic ports are standard—serial, parallel, and external VGA monitor, plus a port for an external Compaq keyboard. But you'll hardly ever need it. The SLT/286's greatest

contribution to laptop artistry is its mobile keyboard, tethered by a 2-foot coiled cord. The keyboard has Compaq-style tactile feedback with an isolated cursor pad and 12 function keys.

The SLT/286 comes with 640K RAM and can accept 1MB RAM SIMMs up to 3.6MB. You can add a 287 math coprocessor and plug a tape drive or external floppy disk drive into a rear port. You can also buy an entire desktop expansion unit that plugs into a rear socket and gives you access to two 16-bit PC boards but, at \$999, it's an expensive way to add two expansion slots.

Compaq invested lots of research into battery conservation; at about 3 hours for ordinary use, the battery does last longer than most hard-disk-based laptops, but not exceptionally longer.

The bottom line with any laptop is the weight. At 14



FACT
FILE

Compaq SLT/286

Compaq Computer Corp.

2055 FM 149

Houston, TX 77070

(800) 231-0900

List Price: Model 20 with 1MB

RAM and 20MB hard disk,

\$3,399; Model 40 with 1MB

RAM and 40MB hard disk,

\$5,999; 1MB RAM modules,

\$799; external 360K floppy disk

drive, \$275; external storage

module, \$299; external 40MB

tape drive, \$799; desktop ex-

pansion unit, \$999.

CIRCLE 443 ON READER SERVICE CARD

pounds plus 2 more pounds for the power transformer, this is not something you want to take on long walks.

In fact, you'll be interested in this pricey machine only if you need power to go at any cost. If you can afford it, though, the SLT/286 is top drawer.



Benchmark Tests: Compaq SLT/286 vs. Zenith SupersPort 286

The biggest difference between the new Compaq SLT/286 and the Zenith SupersPort 286, both 12-MHz CMOS 286-based laptops with backlit displays, lies in the speed of the displays: the Compaq SLT/286 breaks new ground in fast video at the same time it implements VGA. The Zenith SupersPort's one-wait-state memory access gives it an edge in the 80286 Instruction Mix benchmark test, but Compaq's integration of disk and controller puts it ahead in the DOS File Access tests.

Performance Times (Times given in seconds)

	DOS File Access (small record) Mix	DOS File Access (large record) Mix	Video BIOS Routine with Scrolling
Zenith SupersPort 286	5.1	86.4	22.3
Compaq SLT/286	6.0	64.4	5.2

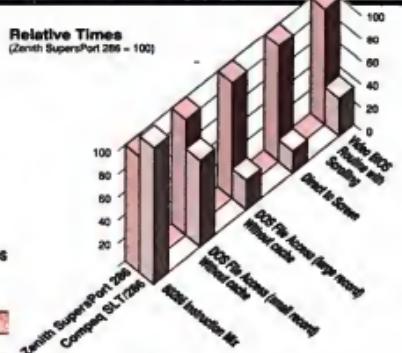
The 80286 Instruction Mix benchmark test measures the time it takes to execute a selected series of processor-intensive tasks. The test programs use 80286 instruction code. These instructions are a subset of the total processor instruction set.

The DOS File Access benchmark test measures the throughput rate of the disk being tested. In this case, throughput times are measured in terms of how long the disk takes to perform common DOS file-management functions. Five tasks—file creation, sequential file write, sequential file read, random file write, and random file read—are timed and the results summed.

The test is carried out for two different types of files—small-record files and large-record files—that are used by common PC applications. Files created using small-record files are typically used by word processing, management programs, and letter recorders; they are typically used for word processing and spreadsheet files. Loading a DOS program is also simulated by the large-record test.

The Direct to Screen test measures the bandwidth of the video adapter by writing directly to the display memory buffer. The test is performed in video mode 3. The screen is cleared and 240 lines of 96 characters each (including a terminating carriage return and line feed) are written to the display through the BIOS Teletype routine. Although the first 24 lines written to the display do not involve scrolling, all the remaining lines scroll the display.

Relative Times (Zenith SupersPort 286 = 100)



register CX equal to 2000. This is done 1,000 times, and the result shown is the total of the 1,000 trials.

The Video BIOS Routine with Scrolling benchmark test measures the speed of the BIOS Teletype routine with scrolling. The test is performed in video mode 3. The screen is cleared and 240 lines of 96 characters each (including a terminating carriage return and line feed) are written to the display through the BIOS Teletype routine. Although the first 24 lines written to the display do not involve scrolling, all the remaining lines scroll the display.

A color photograph of a young girl with dark hair, wearing a white Santa hat and a dark coat, sitting on a porch. She is looking towards the camera. The porch has a white door and is decorated with two small jack-o'-lanterns. The background shows a brick wall and a window with a curtain.

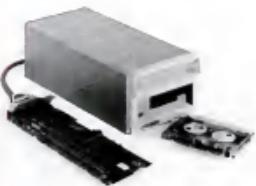
A child doesn't understand a hard disk crash. To her, lost data only means her mother won't be home until late.

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PIPELINE

TOP TEN SELLERS

(A 5-week history)



7 dBASE III Plus 1.1
Ashton-Tate Corp.



8 Lotus 1-2-3 2.01
Lotus Development Corp.



9 PC Tools Deluxe 4.3
Central Point Software



4 WordPerfect 5.0
WordPerfect Corp.



5 Quicken 2.0
Intuit



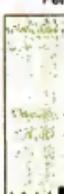
6 Lotus Value Pack
Lotus Development Corp.



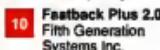
7 Sideways 3.2
Funk Software Inc.



8 Copy II PC 5.0
Central Point Software



9 The Norton Utilities Advanced Edition
Peter Norton Computing



10 Fastback Plus 2.0
Fifth Generation Systems Inc.

IN PERSPECTIVE

The Top Ten Sellers list ranks PC business programs according to their sales performance in the last week of a 5-week period. It also tracks programs' rankings (reading left to right) from August 22 through September 24. A 5-week history is charted to give a sense of a program's sales strength over time. Dramatic shifts in a particular program's ranking may be the result of sales promotions conducted by individual retailers. Seasonal factors, such as end-of-year-budget purchase decisions, can also play a large role in the performance of a particular program in any period. More than 12,000 individual locations contribute to the list.

Sales information compiled by Ingram Software Inc. and PC Connection Inc.

You don't need to be a conductor on a commuter rail line to sense that sales of portable computers are one of the fastest growing segments in the entire computer industry. Most market research organizations have predicted that the trend will accelerate sharply in the next few years. Although the spate of new ma-

chines unveiled this month by Compaq, NEC, and Toshiba will contribute to that growth, a handful of chips that's just about ready to leave the labs is likely to give laptop sales their biggest shot in the arm yet.

When you look at current portable sales, you see that Zenith, NEC, and Toshiba have carved up the laptop market (leaving a very slim piece for IBM), while Toshiba and Compaq have gone head-to-head in selling luggables. Other vendors have taken only crumbs compared with the sales of these leaders.

One advantage these giants have over the legions of also-rans is the

Rankings are based on net sales by unit; returns are subtracted from gross sales.

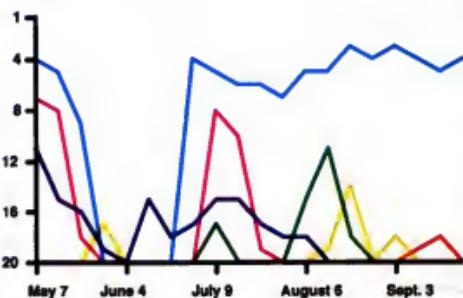
Top Sellers by Category: Word Processors

A quick look at the weekly sales rankings among word processors in a 20 week period shows just how popular WordPerfect has become. Although it's never made it to number one among all software, WordPerfect beats the others in its category for every week in this period except during May and June, when shipments of Version 5.0 began to enter the market.

Because these rankings are based more heavily on retail than direct corporate sales, programs like Microsoft Word and MultiMate appear weaker here than they are overall. MultiMate made it into the top 20 twice in the last 40 weeks and not at all in the last 20 weeks.

- WordPerfect
- PFS:Professional Write
- Microsoft Word 4.0
- Samna Plus IV
- Sprint
- WordStar Professional

(Note that when a product's ranking dips below 20, its plot line ends at the x-axis.)



capital to do large-scale R&D. Although JVC produces many of the hard disks and Sharp supplies most of the screens (even to its laptop competitors), plenty of original design work is needed to build a laptop that draws little power and can still hold its own against a desktop computer.

Start of a New Chapter for Laptops

Chips and Technologies, the company that first cracked the code behind IBM's EGA, is about to give a powerful competitive advantage to all of the also-rans and those who are thinking about joining the fray.

This November Chips and Technologies will sell its Low-Power Enhanced AT Portable (LEAP) chip set to all comers, giving them a head start in laptop design. (Last November Chips and Technologies pumped new blood into the AT-compatible market when it introduced a chip set that reduced the system control of a 12-MHz or 16-MHz 286 PC to a handful of chips. If you see a brand-new 16-MHz 286 PC for less than \$2,000, you'll probably find Chips and Technologies system logic inside.)

LEAP chips will be used

with either 286 or 386X processors. Only 32 static CMOS chips are needed to provide CPU, bus, and memory control; address and data buffers with bus conversion logic; peripheral control; VGA

longer life from rechargeable batteries. Since power demands go up with faster clock cycles and larger RAM sizes, better laptops were starting to look like 20-minute wonders.

Chips and Technologies

A handful of chips that's just about ready to leave the labs is likely to give laptop sales their biggest shot in the arm yet.

graphics; and power control. In simple terms, all the manufacturer needs to do is connect LEAP chips to a processor, hard disk, keyboard, display, and RAM.

If LEAP were a fairly straightforward combination of basic system functions, it would have a modest impact. Manufacturers would be happy to buy most of their design work from one source and, at the same time, leapfrog many of their competitors by providing VGA graphics (now offered only in Compaq's new SLT). But the biggest problem laptop designers face would still plague them—squeezing

goes a long way toward solving the problem with several power-saving tricks in LEAP. A CPU sleep mode cuts power to the processor after interrupts are handled. A suspend mode lets you switch power off and retain the contents of RAM; battery-backed DRAM keeps the memory and CMOS RAM saves configuration registers. And, of course, screen and hard disk activity will be powered down after a selectable period of inactivity.

That means laptops will be able to run at 12 MHz, 16 MHz, or 20 MHz for up to 9 hours, with crisper displays than we've been seeing.

And while the first crop of these machines will probably be about the size of the Toshiba T1100, the Chips and Technologies chip set could be built into a superminiature closer in size to NEC's new UltraLite.

Just as an AT built around Chips and Technologies technology costs less than a Compaq Deskpro 286, LEAP laptops will cost significantly less than Compaq's SLT.

Expect to see the first models next spring.

Where's MS-DOS 4.0?

Ever since IBM shipped PC-DOS 4.0 in July, people have been concerned about bugs in IBM's release and they've wondered if compatible makers would support this flashy new implementation.

Well, the bugs have been fixed; as is customary, IBM quietly fixed the code that had been a problem (the expanded memory manager) and shipped it without announcing a new release.

Meanwhile, Microsoft is now working with compatible vendors to help them finish their own versions of MS-DOS 4.0; the first should be shipping before the end of the year.

—Gus Venditto

Top Sellers by Category: Programming Languages

Sales of programming languages in the top 20 can be summarized in two words: Borland and Microsoft.

Borland's Turbo Pascal continues to be the most popular compiler for the PC, and although Turbo C and Quick C may well represent the future of programming, they've yet to dislodge BASIC from its favored status—not in the past 20 weeks, anyway.



SYMANTEC

TIME LINE

3.0

KEY FEATURES:

Outline Gantt

Network Linkage

May 23, 1988

INFO
WORLD THE
PC NEWS
WEEKLY

PROJECT MANAGEMENT SOFTWARE • REPORT CARD

	(weighting)	Harvard TPM II 2.0	Microsoft Project 4.0	Superproject Expert 1.0	Time Line 3.0
Performance	(225)	Good	Good	Very Good	Excellent
Features/flexibility	(75)	Satisfactory	Very Good	Very Good	Very Good
Recalculation speed	(50)	Satisfactory	Good	Very Good	Excellent
Leveling speed	(100)	Good	Very Good	Very Good	Very Good
Documentation	(125)	Very Good	Very Good	Good	Very Good
Ease of learning	(150)	Good	Very Good	Very Good	Excellent
Ease of use				Very Good	Very Good
Error handling	(75)	Very Good	Very Good	Good	Very Good
Data integrity	(25)	Good	Good		
Error messages				Very Good	Very Good
Support				Very Good	Excellent
Support policies	(50)	Good	Good	Very Good	Very Good
Technical support	(50)	Good	Satisfactory	Good	7.2
Value	(75)	Satisfactory	6.8	7.2	8.8

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PC Editor's Choice,
'86 and '87

Textra 5.2 Adds Page Preview

PC HANDS ON

BY JONATHAN MATZKIN

When *PC Magazine* reviewed *Textra* in our last roundup of word processing software, we found it to be an excellent personal or professional-class program, especially for the money ("Fast, Flexible, and Forward-looking," February 29, 1988). We did have a few complaints, however, and it seems that the folks at Ann Arbor Software were listening. Version 5.2 of *Textra* fixes several of the prob-

lems that we pointed out.

First of all, *Textra* (a true bargain at \$69.95) now has a comprehensive set of printer drivers. Previous versions had generic drivers, but if you really wanted to exploit the capabilities of your printer, you had to key in the control codes yourself.

Installing a printer driver is a simple matter; you choose your printer from an extensive list. The list includes lasers, and there is support for soft fonts as well.

Extensive printer support

helps bring *Textra* into the realm of full-featured commercial heavyweights like *Microsoft Word*, but *Textra* 5.2's second major enhancement goes one better. The new page preview capability might make the big boys a little jealous.

In page preview mode, *Textra* gives you a choice of three different useful page views so that you can see what your output will look like before it is printed.

Full-Page view shows you exactly how your document will print, one page at a time, in a small on-screen window. The preview text is small but clearly readable. This view is available on EGA, VGA, MCGA, and Hercules graphics systems.

Document view shows you a symbolic representation of up to six pages at a time, with text in nonreadable form. This view is useful for looking at the general layout across a number of pages. It is not available to Hercules users.

Color is also required for Page Break view, which gives you a close look at where one page ends and the next begins, with all text in readable form.

A third major upgrade to *Textra* is the new on-line style guide. The guide can be popped

PC FACT FILE

Textra, Version 5.2

Ann Arbor Software

345 S. Division

Ann Arbor, MI 48104

(313) 769-9088.

List Price: \$69.95; upgrade from Version 4.0, \$40.

Requires: 256K RAM, DOS 2.0 or later. Not copy protected.

CIRCLE 442 ON READER SERVICE CARD

up over a document and referred to at any time and contains reference material on style, punctuation, footnoting, and bibliography.

Textra still suffers from a few serious limitations. Most obvious is a file-size limitation of 60K. You must often hit the F3 key to reformat text after moving blocks around, an annoyance most full-featured word processors eliminated long ago. And the command structure, while quite easy to learn, could be a little better organized.

Problems aside, *Textra* is one of the best examples of good software from a small company; for personal use, its low price and powerful features more than offset its shortcomings.



Textra's Full-Page view gives you a look—with completely readable text—at each page of your document before you print it.

TaskNet Relegates Computing Chores

PC HANDS ON

BY RANDOL TIGRETT

When you build a house, you subcontract out some of the work because it isn't possible or practical for you to do it yourself. Similarly, there are computing chores, such as compiling programs and running database reports, that are better done on an underutilized PC than the one on your desk.

TaskNet is designed to increase productivity by letting underutilized PCs on a Novell network process requests from other PCs. These requests consist of DOS commands that can

start programs or initiate batch files on the host PC.

Underutilized PCs run a program—RESP—that polls other network machines for jobs. PCs with jobs to submit send a message explaining the priority of the job. If a submitted task cannot find a PC with the necessary resources, the task stays queued until a PC is available. The RESP main menu shows the status of any submitted job running on the underutilized PC, along with information such as who submitted the job. It also allows a user of the underutilized PC to restrict access to the PC's local disks or regain control of the CPU by aborting a

submitted job.

TaskNet's editor makes it easy for you to create and update task descriptions. The program also lets you check the status of submitted jobs or delete them. On-line help explains the program functions.

The script files that tell *TaskNet* what to do are called Task Directives. You can save Task Directives used in repeated production routines. *TaskNet* results, error messages, and audit trail information are saved in a file you specify.

TaskNet lets people on a network use idle computing resources to increase productivity. If you have a Novell network

PC FACT FILE

TaskNet

CYB Systems Inc.

1950 Siemmons Freeway,

#2064

Dallas, TX 75207

(214) 746-5390

List Price: Server with three responding PCs, \$295; server with eight responding PCs, \$395; server with unlimited responding PCs, \$445. Not copy protected.

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and need to get several computing jobs done at one time, *TaskNet* is ready to serve you.

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WordStar Adds Dazzling Page Preview, Still Falls Short of the Competition

PC HANDS ON

BY EDWARD MENDELSON

Let's jump to the good news first. The print preview function in *WordStar Professional*, Release 5.0, outperforms even *WordPerfect's* impressive preview screen. MicroPro's latest version of its \$495 word processor displays screen fonts that

treats, however, display the same clumsiness and bad planning. MicroPro announced with great fanfare that long-suffering *WordStar* users will finally get automatic paragraph reformatting in Release 5.0—5 or 6 years after almost everyone else. However, the paragraph reformatting isn't very fast, and it doesn't always work when you want it to.

Those familiar with *WordStar* will be pleased to find a second editing window that can be used for a separate document or a second copy of the same document. However, users need to learn new commands if they want to move or copy a block of text from one window to the other. While improving the windows, MicroPro has left *WordStar's* awkward and limited macro function as it was in Release 4.0. You still have to type every single macro keystroke into a separate window, and you still have to press Ctrl-P before typing any Ctrl-key command.

As in earlier versions, you can't set defaults from inside *WordStar* but must use separate customization programs. Some of these customizations lead to strange results. Let's say you customize *WordStar* to turn off its default foot-of-the-page numbering. If you want to add the page number in a header, you have to turn on page numbering again—with the result that you get page numbering at the foot of the page as well as in the header. The manual doesn't explain that you can create an empty footer to avoid the double numbering.

Release 5.0 supports LaserJet and PostScript proportional fonts, but it doesn't know how to handle different font sizes. Every time you change fonts you have to figure out a new line-height command, because *WordStar* doesn't have an auto-leading feature.

Another enhancement allows multiple references to the same footnote—a feature you won't find in most other programs. *WordStar* now knows how to import *Lotus 1-2-3* or *Quattro* worksheets and can even insert a single cell when you specify its address. And *WordStar* users finally have nonprinting comments, easy access to special characters, measurements in inches, snaking columns, and timed backups. MicroPro also now provides

toll-free technical support.

In addition to problems with feature implementations, the package suffers from a few annoying bugs. One of the sample LaserJet envelope files that comes on the disks worked perfectly, provided I only printed one envelope. The second envelope locked up my computer. MicroPro fixed this a few weeks after we pointed it out. It hasn't fixed a bug that causes *WordStar* to garble files when you use it with one of the standard cursor-speedup programs. Scrolling through a document when one of these programs is resident can cause characters to disappear.

As with earlier versions, MicroPro throws a few other programs into the *WordStar* package. You get a telecommunications program that you can run from *WordStar's* main menu or as a standalone, and a file manager that can only run separately. The WordFinder thesaurus is now integrated into the program, but PC-Outline remains separate.

If you use *WordStar* and don't mind relearning a few command sequences, the new features in Release 5.0 are worth the upgrade. Balanced against a clumsy user interface and other problems, however, the enhancements in Release 5.0 do little to elevate *WordStar* to the level of its competition. If you don't use *WordStar*, don't start now.



WordStar Professional, Release 5, adds pull-down menus, which are invoked by using Alt-key combinations. The menus show the corresponding old Ctrl-key commands.

look exactly like your printer fonts, rather than representing them generically. It can display any view of a document from an expanded view of a single page to a thumbnail view of multiple pages—up to 32 pages on a VGA monitor. It can overlay a grid over the preview screen for exact measurements. And once it generates its screen fonts for your monitor, it works fast.

Unfortunately, the bad news begins with the page preview also. The page preview displays only a standard 8½" by 11-inch page. Legal users won't be able to preview the bottom 3 inches of 14-inch pages, no matter how many defaults they change. If you print in landscape mode, you won't be able to preview the right edge of the page.

Few other features in the new *WordStar* display the same technical razzle-dazzle as the page preview. Many other fea-

For example, if you copy a block to the end of a paragraph, you have to reformat the paragraph manually if you don't want it to print partly in the right margin. If you go back to text you've typed and insert a text command that changes the left margin, you must reformat the document with the Ctrl-QU command if you want the new margin to take effect.

WordStar also introduced new pull-down menus based on IBM's SAA standard while also keeping modified forms of the standard menus from earlier versions. You pull down the new menus with Alt keys and then move the highlight down to the command you need. *WordStar* loyalists will prefer to turn off the new menus and use the old commands—although enough of the old commands have been changed to make the new version hard to get used to.

PC FACT FILE

WordStar Professional,

Release 5.0

MicroPro International Corp.
33 San Pablo Ave.

San Rafael CA 94903

(415) 499-1200

List Price: \$495 (upgrade
\$119).

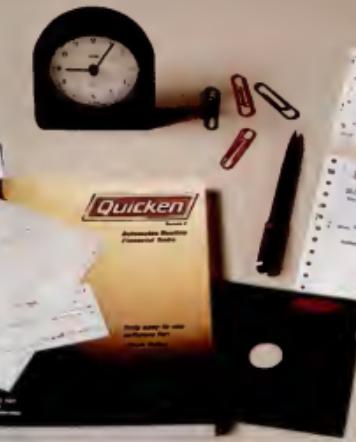
Requires: 384K RAM (512K RAM for page preview), DOS 2.0 or later. Not copy protected.
In Short: Added features fall short of revitalizing this outdated word-processing favorite.

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"I've never seen such an easy-to-use manual or software that's so simple to use." *Martin Blumenthal, in Cider Magazine*

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Esther Dyson, Industry Analyst

"Absolutely the best small accounting program made." *Bob Schwabach, Universal Press Syndicate*

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MapInfo Interactive City Maps: Locate Addresses, Zoom to 55 Feet



HANDS ON

BY DONALD B. TRIVETTE

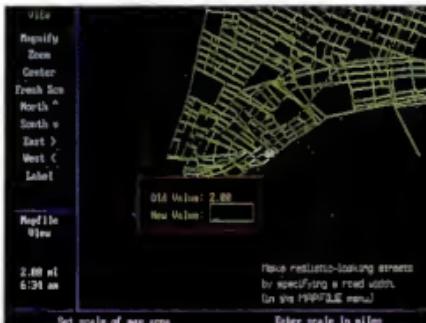
If Julius Caesar had had a personal computer, he could have used *MapInfo* to divide Gaul into three parts. He would also have seen that all roads did not lead to Rome.

MapInfo displays, labels, and manipulates maps in a variety of ways. Instead of ancient Rome, the program comes with a boundary map of the United States showing major metropolitan areas and a tutorial map. The company will be delighted to sell you any of the thousands of maps it has in its library. Prices range from \$250 for medium-size cities to \$2,000 for places like New York, Chicago, and Los Angeles. Gaul, now known as France, and other parts of the world will be added to the library soon.

Using *MapInfo* is a breeze, especially with a mouse. Click on Zoom and the program prompts you for a distance in miles. Enter "1," for example, and the map will be scaled so that the distance across your screen represents 1 mile. You

can zoom in as close as 55 feet or as far out as 5,000 miles.

Using the Locate menu you can search for any point or address on the map. Just type the address, and *MapInfo* will zero in on its location. In most cases individual building addresses aren't actually stored. Instead, the program interpolates an approximate location from databases that contain block numbers and side-of-the-street information.



In this map of lower Manhattan, the distance across the screen is 2 miles. With *MapInfo*, you can change the scale to anywhere from 55 feet to 5,000 miles.

More-exact figures are calculated for longitude and latitude. Aim the cross-hairs on a point, click, and *MapInfo* displays the location to six decimal places. *MapInfo* also calculates distances between points in miles and fractions of miles. Version 3.0, due out by the time you read this, offers alternative units such as meters or feet.

Using the Draw menu you can add buildings, color in areas, create boundaries, and la-

MapInfo, Version 2.0

MapInfo Corp.
200 Broadway
Troy, NY 12180
(518) 274-8673
List Price: \$750; \$250-\$2,000 per metro map.
Requires: 640K RAM, hard disk, graphics display, DOS 2.0 or later. Not copy protected.

CIRCLE 431 ON READER SERVICE CARD

bel individual points. Version 3.0 will even color points based on data values; homes selling for less than \$100,000, for example.

MapInfo can read data from dBASE files and display the points along with other information. You don't even have to tell *MapInfo* the structure of the database—the program figures it out for itself.

Version 3.0 will add a C-like programming language to let *MapInfo* be used as a platform for third-party developers.

Maps may be printed or plotted to a wide variety of devices, but each has its own fixed output size. One of *MapInfo*'s weaknesses is that it can't scale printed output.

H FACT FILE

9 To 24 Pin Printer Translator

Foresight Enterprises Inc.
3438 Laredo Ln.
Escondido, CA 92025
(619) 743-5315
List Price: \$49.95
Requires: 1K RAM, 24-pin printer, DOS 3.0 or later. Copy protected.

CIRCLE 430 ON READER SERVICE CARD

24-Pin Output from 9-Pin Drivers



HANDS ON

BY JENNIFER ZAINO

9 To 24 Pin Printer Translator may not be the most catchy name for a program, but it certainly does sum up the function of Foresight Enterprises' \$49.95 software utility. The program translates the 9-pin output of software that doesn't specifically support 24-pin printers into full-fledged 24-pin output. Such programs include versions of *Ventura Publisher*, *AutoCAD*, *Dr. Halo III*, and *Lotus 1-2-3*.

The product provides what Foresight calls NQL (near-laser-quality) graphics output to

owners of some of the most popular 24-pin printers, including the Epson LQ series, Okidata's Microline 391, Toshiba's P321 and P341SL, as well as Alps, Brother, IBM, Panasonic, Seiko, and Star models.

Eighteen separate drivers are included or one 5½-inch disk (3½-inch microfloppy disks are also available)—you can experiment until you find the one that works best with your printer and software. For instance, I found that my Epson LQ-950 printer responded best to the CT driver when used with Broderbund's *The Print Shop*—the graphics output was darker and denser than when used with Foresight's LQ driver.

However, I was pleased to find that all of the drivers I used produced higher-quality output than the 9-pin graphics programs previously allowed. In addition to better graphics quality, 9 To 24 Pin drivers make it possible to fit a page's worth of graphics neatly on a single sheet, thereby eliminating the problem of stretched graphics that has plagued owners of 24-pin printers.

There's not much you have to know to use the program—a blessing since the documentation is so poorly organized. That's a minor problem compared with the fact that the program is still copy protected, although the company is planning

to remove copy protection.

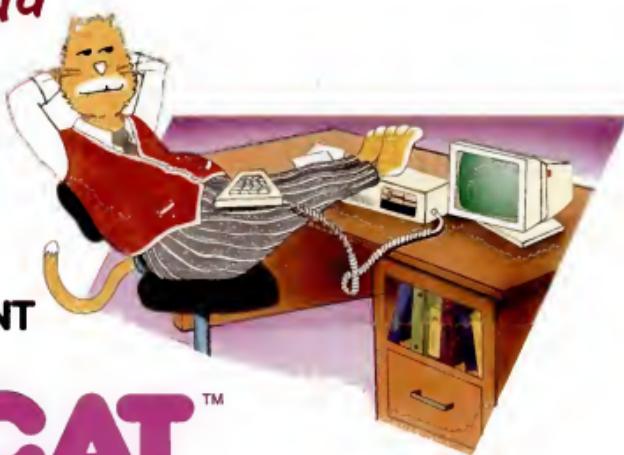
Despite the package's few flaws, owners of 24-pin printers will welcome the chance to take full advantage of their printer when using 9-pin graphics programs.

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NEW ON THE MARKET

by Jonathan Matzkin

Corporate Database Puts the Fortune 500 At Your Fingertips

Fortune 500 Prospector, from *Fortune* magazine and MZ Group, is a software version of the magazine's famous listing of America's biggest corporations. The \$199 software package contains data on both the Fortune 500 and the Fortune Service 500, a listing of nonindustrial corporate heavyweights.

Like the print version, *Fortune 500 Prospector* has a trove of financial data about each listed company, including profitability, equity, sales, earnings per share, and return on investment. The software also includes information not found in the printed listings, such as complete addresses, telephone numbers, key executives, and a brief description of each corporation. The database will be updated yearly.

Users can add companies to the database or add information to those already listed. *Fortune 500 Prospector* generates 18 different preformatted reports and prints mailing labels and rotary file cards. Since the software is built on Borland's *Paradox* database system, users of that program can customize *Fortune 500 Prospector* extensively.

F1 Help	F4 View notes	F2 View notes	F3 Edit company	F5 File copy/paste	F7 View list	F8 Print company	F9 More	ESC New
6. Schools=								
<i>Appeared in Fortune 500 Ranked by Sales</i>								
\$1.2								
Bales	0 mil	x change						
Books	46.0	19.1						
Books	224.0	23.1						
Books	125.0							
Books	322.0							
Books	1,311							
FORTUNE 500	1988	1987	Change	1988	1987	Change	1988	1987
Profits	0 mil	x change						
Profits	19.0	38.5						
Profits	19.0	38.5						
Profits	4.27							
Profits	15.75							

Fortune 500 Prospector, from *Fortune Magazine* and the MZ Group, is a \$199 database implementation of the magazine's famous listing of corporate giants.

List Price: *Fortune* 500

Prospector, \$199. Requires: 512K RAM, hard disk, DOS 2.0 or later. Not copy protected. MZ Group, 1388 Sutter St., #612, San Francisco, CA 94109; (800) 345-9111.

CIRCLE 438 ON READER SERVICE CARD

Data cartridges for *The Classic Disk Drive*

contain only the platter; the

**Removable Hard Disk From Cumulus Boasts Low-Cost Cartridges**

The Classic Disk Drive, a removable Winchester disk subsystem from Cumulus Corp.,

features 44MB cartridges that cost \$149. The subsystem is available for internal or external use; with a single platter it costs \$1,295. Controllers are available for either the AT (\$149) or Micro Channel (\$199) bus.

The drive is different from most other removable Winchesters, Cumulus says, because only the disk platter is removed,

leaving behind the 3½-inch head and disk assembly. As a result, the cartridges stand up to rougher treatment than other removable media will tolerate.

The drive is sold with backup software that has a "shadow backup" capability. Cumulus says that the software maintains an up-to-the-moment backup of a system's primary hard disk. If

(continued on page 52)

HOT PROSPECT

Marq Technologies Mouse Mixes Image Scanner, OCR Capability

Inventors have always sought a better mousetrap, but Marq Technologies claims to have a better mouse. The new PC rodent (prices start at \$199), named the MarqMouse, is the basis for an input system that includes image scanning and OCR (optical character recognition) with audio feedback.

The Microsoft- and Logitech-compatible MarqMouse offers up to 600-dot-per-inch resolution. "Ballistic control" allows tight control of both large movements across the full screen and small, precise movements in a small area of the display, according to Marq Technologies.

A small port at the front of the mouse accepts an add-on scanner option. The scanner (upgrade, \$799) offers 300-dpi scanning resolution with 16 levels of gray-scale recognition. The scanner's tracking system allows it to be moved across an image "paintbrush-style," so

that an image of any size can be accurately scanned. This eliminates a significant limitation in most hand scanners, which can input only very narrow images.

An optional OCR reader also snaps into the MarqMouse port (upgrade price, \$1,299). Marq Technologies says that its software recognizes proportional spacing and multiple font types and sizes. The software is optimized for numeric data and does not support text. An audio feedback feature pronounces each number as it is input (through an external speaker), allowing for auditory proofing.

List Price: MarqMouse, \$199. With scanner option, less than \$1,000. With OCR option, less than \$1,500. **Requires:** 256K RAM, full-length slot, DOS 2.0 or later. Software not copy protected. Marq Technologies, 6285 Nancy Ridge Dr., San Diego, CA 92121; (800) 336-8366.

CIRCLE 432 ON READER SERVICE CARD



The MarqMouse (\$199) is the basis for an input system that can include an add-on scanner (shown) or OCR device.

NEW ON THE MARKET

Disk Drive

(continued from page 51)

the primary drive fails, the software automatically shifts operation on-the-fly to the backup drive. The software also supports periodic, scheduled, or on-demand backup.

List Price: The Classic Disk Drive, \$1,295; additional data cartridges, \$149. **Requires:** 512K RAM, expansion slot, DOS 2.0 or later. Software not copy protected. **Cumulus Corp.,** 23500 Mercantile Rd., Cleveland, OH 44122; (216) 464-2211.

CIRCLE 435 ON READER SERVICE CARD

Programmer's Library Added to Microsoft's List of CD-ROM Titles

The promise of CD-ROM is fast access to huge volumes of information. Microsoft has taken another step toward the fulfillment of that promise with the release of *Microsoft Programmer's Library*, which packs more than 20,000 pages of reference material and sample code onto a single CD.

Programmer's Library includes 48 books and technical manuals on Microsoft operating systems and languages. The information ranges from quick-reference help to more-in-depth material, grouped into nine categories: MS-OS/2, Windows,

MS-DOS, C, BASIC, Macro Assembler, Pascal, FORTRAN, and hardware. Among the several books included are *Inside OS/2*, by Gordon Letwin, and *Programming Windows*, by PC Magazine contributing editor Charles Petzold. The library's 1,200 sample programs would require 20 floppy disks to store them.

All of the material in *Programmer's Library* can be accessed from inside a text editor or word processor and copied directly into programs or documents. When the library is popped up within a text editor or word processor, the word at the cursor can be automatically searched on. The library can also be run as a standalone program and is extensively cross-referenced.

List Price: *Microsoft Programmer's Library*, \$395 through December 1988.

Requires: 640K RAM, CD-ROM disk drive with MS-DOS CD-ROM extensions, DOS 3.1 or later. Software not copy protected. **Microsoft Corp.**, 16011 NE 36th Way, Box 97017, Redmond, WA 98073; (206) 883-8080.

CIRCLE 437 ON READER SERVICE CARD

Power Protection Unit Fits Inside Case, Saves Complete System State

Microsync Inc. has introduced a power protection system that

NEC ProSpeed 386 Portable Machine Is At Home on the Office Desk or on the Road

The NEC ProSpeed 386, from NEC, bridges the gap between the desktop and the field by providing power for the office and portability for traveling. The modular system consists of a detachable portable computer with a hard disk and LCD screen, and a large \$1,199 power supply/expansion unit (called a "docking station") that remains behind on the desk.

The portable is driven by a 16-MHz 80386 processor and comes with a 40MB (\$7,699) or 100MB (\$8,999) hard disk and a 1.44MB floppy disk drive. The LCD screen displays CGA and EGA graphics; VGA support is included for an optional external monitor. Standard are 2MB of 32-bit, 100-nanosecond RAM, expandable to 15MB. The portable module weighs 17.6 pounds, NEC says, and the optional \$349 battery attachment (for 2 to 3 hours of operation) adds 4.6 pounds. Stan-

dard ports include one parallel, one serial, and one VGA port. An AC/DC power source is built in.

The docking station attaches to the rear of the portable, for a total system depth of 24 inches. It duplicates the ports on the rear of the portable and adds a second serial port, an external keyboard port, two RJ-11 connectors, and an AC power outlet. It also adds three full-size 16-bit expansion slots and one full-size 8-bit slot.

List Price: NEC ProSpeed 386, with 40MB hard disk, \$7,699; with 100MB hard disk, \$8,999. Optional battery unit, \$349. Docking station, \$1,199. **NEC Home Electronics (USA) Inc.**, 1255 Michael Dr., Wood Dale, IL 60191; (312) 860-9500.

CIRCLE 438 ON READER SERVICE CARD

The NEC ProSpeed 386 (\$7,699 with 40MB hard disk) combines the power of a desktop machine with the versatility of a portable.



19-Inch IBM Mono Monitor Supports 8514 Graphics Adapter, Up to 64 Shades

IBM has unveiled a 19-inch monochrome monitor suited to desktop publishing, graphics, and large spreadsheet applications. The \$867 IBM Monochrome Display 8507 supports up to 16 shades of gray when used with the PS/2 Display Adapter 8514/A, and up to 64 shades of gray when the IBM 8514 Memory Expansion Kit is added.

The analog monitor can handle resolutions of up to 1,024 by 768 pixels and has a viewing area of 14 by 10½ inches. IBM says that the monitor can be used with older PCs in addition to the current PS/2 line.

List Price: IBM Monochrome Display 8507, \$867. Contact your local IBM dealer.

CIRCLE 439 ON READER SERVICE CARD

fits completely inside your CPU case and protects against data loss. When the Boomerang detects a power outage, the combination hardware-and-software system supplies battery power while saving the entire state of your system to your hard disk. Once normal power is resumed, a simple command restores the computer to its state at the time of interruption, according to Microsync.

Boomerang does not require an expansion slot; it installs between the power supply and the

motherboard.

Microsync says Boomerang also lets you simply turn off power at any point within an application. When you power up again, the device returns your system to where you left it.

List Price: Boomerang, \$299. **Requires:** 256K RAM, hard disk, graphics adapter, DOS 2.1 or later. Software not copy protected. **Microsync Inc.**, 15018 Beltway Dr., Dallas, TX 75244; (214) 788-5198.

CIRCLE 440 ON READER SERVICE CARD

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The Norton Commander 2.0 Adds Lotus 1-2-3, dBASE File Viewers

PC HANDS ON

BY CRAIG STINSON

Even if you've sneered at DOS shells in the past, you might want to take a look at the new version of *The Norton Commander*. This is a shell for pros as well as novices.

The reason for *The Commander's* versatility is simple: it leaves the DOS prompt visible on-screen and gives you the best of both worlds. If you want to talk directly to DOS in the time-honored manner, you may do so; if you want to use *The Commander's* own facilities for copying, renaming, moving, deleting, or executing files, you may do that as well.

Moreover, *The Commander* is easy on memory. You can run it in either of two modes—pass-through or resident. In pass-through mode, the program uploads all but 12K of its contents when you execute an application. In resident mode, it eats up 108K but reappears instantly when you return from an application to DOS.

At the heart of *The Commander* is a visual construct called a panel. A panel displays a file listing for the current directory, status information about the current directory, or a

tree diagram for the current drive. You can have either one, two, or no panels visible at any time.

The Commander streamlines DOS operations in a couple of ways. First, it keeps a history of your 15 most recent DOS commands and presents that history at the touch of an Alt-function key. You can easily replay the command you used 20 minutes ago just by selecting it from the history window. Second, it enables you to carry out commands on many files at once; just tag the files you want to copy, delete, or whatever (using mouse or keyboard), and go.

The program warns if you're about to overwrite an existing file or delete a hidden, system, or read-only file.

Version 2.0 of *The Commander* is mostly a slicker implementation of Version 1.0, with pull-down menus replacing a more command-oriented style. But there are a few important new goodies.

Two programs from *The Norton Utilities* 4.0 have been incorporated into the new *Commander*. FF (File Find) helps you find misplaced files on a disk, and NCD (Norton Change Directory) lets you navigate your disk directories by walking

The Norton Commander, Version 2.0

Peter Norton Computing
2210 Wilshire Blvd., #186
Santa Monica, CA 90007
(213) 749-4804

List Price: \$89; upgrades, \$33
Requires: DOS 2.0 or later,
256K RAM. Not copy protected.

CIRCLE 440 ON READER SERVICE CARD

through a tree diagram.

Version 2.0 supports multiple user-defined application menus (but not submenus, unfortunately); Version 1.0 supported only a single menu. It also includes a handy command that compares two directories, highlighting any filenames that exist in one but not the other.

Most important, the new *Commander* includes a smart file viewer (a sort of scrollable Type command) that knows how to read 1-2-3 .WK? and dBASE .DBF files. Thus you can inspect your spreadsheets and databases from DOS.

The trouble with DOS shells has always been that they impose their own ways of doing things, often to the disadvantage of skilled users. This one is different: it really lets you have your cake and eat it too.



The Norton Commander's dBASE file viewer shows the field structure of a .DBF file as well as contents of individual records.

FormGen II Challenges FormTool Lead

PC HANDS ON

BY PAULA SEELEFTDT

Streamlining is the key to FormGen's self-proclaimed "WYSIWYG low-end form processing package," *FormGen II*. The product is designed to compete against the frontrunner, BLOC Development's *FormTool*.

Forms are created by using the cursor as an electronic pencil with the screen acting as a drawing pad. Line width consists of three different sizes: sin-

gle, double, and thick.

Column or row space may be inserted, but unlike *FormTool*, there are no automatic grid configurations, so all formats must be drawn manually.

FormGen II also differs from *FormTool* in its inability to convert database files. Text must be typed in, vertically or horizontally, or added through text windows. Text windows enable the user to conveniently change font size and characters of less than 10 pitch. *FormGen II* has six standard font types.

Also included is a justifica-

tion feature that automatically aligns the text. A check box prints boxes and circles, and text shading applies light, medium, or heavy tones.

Forms may be saved as standard .FRM files, in an R-base format, or as ASCII text files. Conversion to ASCII enables the forms to be used in other programs, but they cannot then be returned to the drawing pad.

Overall, *FormGen II* delivers what is promised: no-hassle, good-quality blank office forms. For the same price, however, *FormTool* provides all

PC FACT FILE

FormGen II
FormGen Corp.
64 Healy Rd.
Bolton, Ontario
Canada L7E5A4
(416) 857-0022
List Price: \$99
Requires: 256K RAM, DOS 3.1 or later. Not copy protected.

CIRCLE 441 ON READER SERVICE CARD

those attributes plus features such as split-screen viewing, data math, and file import.

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Windows Open (maximum)	6	2	8	1	1
Files Open (maximum)	24	2	8	1	1
Cross-Reference (dynamic)	●	○	○	○	○
Indexing Options	7	1	3	3	○
Columns: Parallel	●	●	●	●	●
Snaking (chg. * same page)	●	●	Not same pg.	○	●
H-P LaserJet Support	Full	Partial	Full	Partial	Full
PostScript Support	Full	Text	Full	○	Text
Mouse Support (integrated)	●	○	●	○	○
Dynamic Shortcuts	●	○	○	○	○
Alternative User Interfaces	●	○	○	○	○
Verify Spelling as you type	●	○	○	○	○
Programmable Macro lang.	●	○	○	○	○
Save File ¹	5.9	41.1	9.7	4.4	1.0
Top to Bottom ²	7.5	7.5	49.4	8.1	21.0
Search and Replace ³	1.6	6.6	4.6	17.1	13.4
Find Unique Word	3.3	6.2	7.0	13.8	20.6
Suggested List Price	\$199.95	\$495.00	\$450.00	\$495.00	\$565.00

Time tests were performed on an Acer 206 (8 MHz), 640K RAM. ¹For file size 1032. ²1636 lines. ³14 occurrences. Times shown are in seconds.
(Benchmark details available upon request.)

Fees and specifications subject to change without notice.

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Borland's Turbo Pascal 5.0 Adds Overlays, 80x87 Emulation, Debugger

PC HANDS ON

BY NEIL J. RUBENKING

Last year Borland International upgraded its flagship product, the Turbo Pascal compiler, to Version 4.0. The most important of the many improvements were separate compilation of Units and the ability to create .EXE programs. Were Turbo Pascal programmers grateful? No, they immediately began clamoring for still more enhancements. Users wanted 80x87 emulation, overlays, access to the runtime library source, and most of all they demanded a debugger.

Turbo Pascal 5.0 has all the requested features, and its built-in debugger is a dream. For wizard-level programmers, Version 5.0 also supports the new standalone Turbo Debugger. A host of other enhancements at all levels brings Turbo Pascal 5.0 into Borland's new Professional Language series.

There are four basic techniques in using the integrated debugger: single-stepping, setting breakpoints, creating watch expressions, and evaluating expressions. These options all appear in the pull-down menus, but you'll quickly learn their dedicated function keys.

By pressing the single-step key repeatedly, you execute your program one line at a time, returning to the source code after each line. In the source, an "execution bar" highlights the next program line. Single-stepping can be rather slow, though, especially if the suspect code comes in the middle of the program.

You'll probably prefer to run the program full-tilt and then stop just before the suspect code. As many as 21 breakpoints let you do just that. Set a breakpoint on any executable line, and the program will pop into the debugger just before executing that line. Or select "Run to Cursor" and the program will run until it reaches the

line the cursor is on. The Ctrl-Break key combination acts as a manual breakpoint—hit it and you come back to the source.

As you step through your program, it's useful to keep track of variables. At any time you can bring up an Evaluation window and display the value of a variable or expression. The Evaluation window is smart—it grabs the variable name under the cursor as a default and will display variables in many formats. You can typecast in the Evaluation window and, best of all, you can change variables. If

a procedure in any Unit or Include file of your program. And if you have two monitors available, you can put the program source on one, the output on the other.

Turbo Pascal 4.0 added a set of useful IEEE floating-point data types. However, programs compiled using these data types would run only on systems with a math coprocessor. With Version 5.0 you can write programs that use the IEEE data types on any computer. If the math chip is present, they'll take advantage of its speed; if not, they'll



The Turbo Pascal 5.0 debugger Evaluation window lets you display the value of any variable or expression. You can also alter the variable's value.

a bug seems to surface only when one variable has a certain value, just set it to that dangerous value and watch the fire works.

When you're tracking down an unplanned change to a variable, Evaluating after every line gets tiresome. Instead, put that variable (or expression) in the Watch window. Now its value gets updated every time you return to the debugger.

The integrated debugger includes a number of other handy features. Its Call Stack keeps track of the last 128 procedure/function calls. At any point in the program, you can check the Call Stack to see how you got there. You can use the Find Procedure option to locate

emulate it in software.

Overlays are back—and better than ever. A single procedure call makes your program stash overlays in EMS if it's available. And the old problem of finding the overlay file on disk is no problem now. Turbo Pascal 5.0 programs automatically search for the overlay file, first in the current directory, next in the .EXE file's directory (in DOS 3.x), and finally anywhere on the path. In Version 5.0, you overlay whole Units, and there's no longer any restrictions on calling other routines in the same overlay group.

Turbo Pascal 5.0 also adds features in the DOS, environment, graphics, and file handling areas. Built-in routines re-

trieve environment by name or number. For example, "GetEnv('PATH')" retrieves the full DOS path. Most impressive of all is the FSearch procedure: given a filename and a list of directories in DOS PATH format, it will search for the file in those directories.

The Borland Graphics Interface (BGI) now supports the IBM 8514 adapter in its full 1,024- by 768-pixel 256-color glory, though it doesn't offer 256 colors on the VGA. New routines allow installation of third-party BGI drivers and fonts. As yet, the specifications for fonts and BGI drivers aren't available to the public.

Every serious Pascal programmer will upgrade to Version 5.0. The benefits are enormous, and the only disadvantage is that you'll have to recompile all your Units. If you're using store-bought Units without source code, you'll need an update from the publisher. But your own code will recompile under the new version with no change except a few compiler directives. □

FACT FILE

Turbo Pascal 5.0
Borland International Inc.
1800 Green Hills Rd.
Scotts Valley, CA 95066-0001
(408) 438-8400

List Price: Turbo Pascal 5.0, \$149.95; Turbo Pascal Professional (includes Turbo Assembler and standalone Debugger), \$250; upgrade from Turbo Pascal 4.0 (update manual, new disks), \$49.95; upgrade to Professional (all-new manual, Turbo Assembler, standalone Debugger), \$99.95.

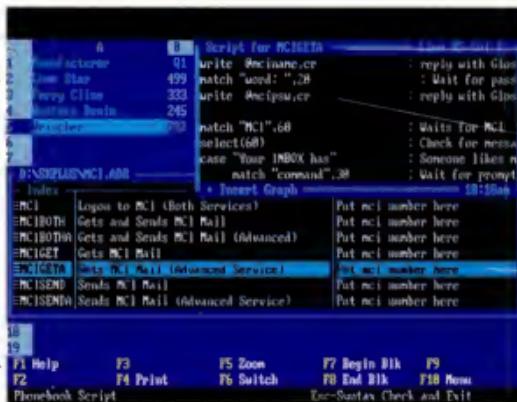
Requires: 448K RAM (256K RAM for command-line version); will use EMS for editor if available; DOS 2.0 or later.

In Short: This latest evolution of Turbo Pascal adds overlays, 80x87 emulation, and new standard features, but the real prize is the integrated debugger. Not copy protected.

CIRCLE 448 ON READER SERVICE CARD

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- 1 Parallel, 1 Serial, 1 Game, Clock
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RGB SYSTEM \$ 815
EGA SYSTEM \$1050

HAR O OPTIONS:
38MB \$256
30MB \$225

STI 286-10



Standard Features:

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- Landmark 12 MHZ
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- Eight Expansion Slots
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- Enhanced 101-Key with Tactile/Click Keyboard
- 286 Turbo Case
- Operations Manual
- One Year Warranty

\$5 See Price Table \$5

STI 286-12



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- Operations Manual
- One Year Warranty

\$5 See Price Table \$5

STI 386 TOWER



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- One 32 BIT Memory Slot, Up to 10MB
- 8 or 10 MHZ 80287 CO PROCESSOR Socket
- Enhanced Timer Clock, 8087 Adapter Board as an Option
- 200WAT UL Power Supply (Tower Systems: 250WNT)
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- One Year Warranty, Operations Manual

\$5 See Price Table \$5

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	286-10	286-12	386-16
MONO SYSTEM WITH 12" MONITOR	\$1050	1120	1985
MONO SYSTEM WITH 15" FLAT SCREEN	\$1080	1180	2045
RGB SYSTEM WITH 14" MONITOR	\$1190	1290	N/A
EGA SYSTEM WITH 14" MONITOR	\$1605	1505	2400
VGA SYSTEM WITH 14" MONITOR	\$1650	1750	2695
MULTI-FREQ 800MHZ 14" MONITOR	\$1645	1745	2780

STI 586 Options Available:
• 80587 Adapter Board \$ 85
• 20 MHZ Option \$250
• Tower Case/250W Power \$800

MONITORS

• SAMSUNG AMBER, 12", TTL SWIVEL BASE, 720 x 560, 80 + 25	\$ 75
+ TATUNG CN-1485, 14" MULTI-FREQ 800 MHZ, TILT/SWIVEL	\$99

QUIMAX

• DM 14, HIGH RES. MONOCHROME MONITOR 14", 750 x 512, 135 COLUMNS x 44 LINES	118
• DM 15, 15" AMBER FLAT, 750 x 510	155
100% 100% 100%	
• DM 154, RGB 640 x 800, 14"	850
• DM 2214, EGA MONITOR 720 x 350, 64 COLORS	560
• DM 5112, 12" VGA, 480 x 200	560
• DM 5114, 14" VGA, 480 x 280	645

• KEYTRONIC 101 KEYS 56

HARD DISKS

• ST-115 40MBS	\$885
• ST-235 100MBS	110
• ST-235 210MBS	139
• ST-355 50MBS GIMS	736
• ST-355 KITB 50MBS	295
• ST-4096 30MB 72MMS	640
• ST-254 40MB 40MMS	570
• ST-254 40MB 50MMS	455

FLOPPY DRIVES

• TEAC 350K	\$ 82
• TEAC 750R	98
• TEAC 1.2M	98
• TEAC 1.44M	130
• MITSUMI 560K	75
• MITSUMI 720K	85
• MITSUMI 1.2M	85
• MITSUMI 1.44M	110

Z-NIX MOUSE

• HI-RES MOUSE W/TURBO	\$105
• Z-NIX MOUSE	50
• SERIAL MOUSE	40
• BUS MOUSE W/PC	66
• PAINTBRUSH OR DR. HALO III	56
• SERIAL MOUSE W/PC	56
• PAINTBRUSH OR DR. HALO III	25
• PC PAINTBRUSH	25
• TURBO CAD	45

MOONS

• EVEREX 1200 INTERNAL	\$ 80
• EVEREX 2400 INTERNAL	116
• 5000 STYLE KEYBOARD	\$ 45
84 KEYS, LARGE RETURN KEY, 3.5MM	45
• 2101 STYLE KEYBOARD	57
TACTILE/CLICK, 101 KEYS, 12F KEYS SEPARATE NUM & KEYPADS	57
• KEYTRONIC 101 KEYS	56

KEYBOARD

Standard Features:

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- Dual Speed 6/10 MHZ
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- Landmark 12 MHZ
- 200WAT UL Power Supply
- Eight Expansion Slots
- One 1.3MB Floppy Drive
- Dual Floppy and Hard Disk Controller
- 1 Parallel, 2 Serials, Real Time Clock, Game Port
- Enhanced 101-Key with Tactile/Click Keyboard
- 286 Turbo Case
- Operations Manual
- One Year Warranty

\$5 See Price Table \$5

Standard Features:

- 8128K Memory 100NS, Expandable to 1MB
- Dual Speed 6/12 MHZ
- 0 Wan State
- Landmark 12 MHZ
- 200WAT UL Power Supply
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CIRCLE 738 ON READER SERVICE CARD

PC UPDATE

edited by Paula Seefeldt

Nota Bene 3.0 Unites with RamFont Video Mode

Nota Bene, the word processor and text-retrieval system from Dragonfly Software, now supports Hercules RamFont video cards. The combination of *Nota Bene*, Version 3.0, and a RamFont card allows users to design up to



RamFont Video Mode supports **Nota Bene's language supplements.** 3,072 custom characters and mix graphics with text and foreign-language supplements. Language supplements are available in Russian, Greek, Hebrew, and other non-Western European alphabets. Upgrades to *Nota Bene* 3.0 are \$50, and new packages retail for \$495. *Nota Bene* 3.0 is compatible with the Hercules Graphics Card Plus, the Network Card Plus, and the Incolor Card. Dragonfly Software, New York, N.Y.; (212) 334-0445. Hercules Computer Technology Inc., Berkeley, Calif.; (415) 540-6000.

PC Tools Deluxe Expands Programs

PC Tools Deluxe, from Central Point Software, has added several new programs: PCSHELL, a superset of the DOS 4.0 shell; PCDESK, a desktop manager; and DESchutes, a file-encryption and -compression program. *PC Tools Deluxe*, Version 5.0, also has a new user-interface with pull-down windows, and Central Point Software has added new features to the existing programs, PCBACKUP and COMPRESS. Upgrades are available for \$15. Retail cost is \$79 for first-time buyers. Owners of competing products may upgrade to *PC Tools Deluxe* for \$25 plus proof of purchase. Central Point Software, Beaverton, Oreg.; (503) 690-8090.

FoundationWare Eliminates Illegal Software

FoundationWare Vaccine Corporate now prevents the use of unauthorized software on IBM PCs and compatibles. Version 2.1 also reduces data loss while increasing productivity. In addition, the accompanying Blue Disk provides a database of certified virus-free signature checks from over 5,000 programs. *FoundationWare Vaccine Corporate* 2.1 retails for \$189. FoundationWare, Cleveland, Ohio; (216) 932-7717.

Laser Fonts Works with WordPerfect 5.0

Laser Fonts, Version 4.0, from SoftCraft, now supports *WordPerfect* 5.0. The enhanced *Laser Fonts* can also install any soft font so *WordPerfect* users can access bitmap font libraries. HP LaserJet Series II users are given extra options with *WordPerfect's* Font Appearance menu. Updates are \$25 and new packages retail for \$180. SoftCraft Inc., Madison, Wis.; (608) 257-3300 or (800) 351-0500.

UniSaver Model 100 Supports LIM 4.0

Universal Vectors' *UniSaver Model 100* now provides LIM 4.0-compatible expanded memory and extended memory. Current *UniSaver* users will receive the upgrade, a new PROM for the RAM/system board, and installation instructions free of charge. All new *UniSavers* will include the upgrade and will retail for the original price of \$1,495. Universal Vectors Corp., Herndon, Va.; (703) 435-2500.

Lotus Entices with Free Upgrade

Lotus is offering a free upgrade to *Lotus 1-2-3*, Release 3, for anyone who purchases Release 2.01 between September 6 and 30 days after shipment of Release 3. Release 2.01 retails for \$495, and shipment of Release 3 is scheduled for the fourth quarter of the year. Registered users of Release 2.01 will be able to upgrade for \$150. Upgrades for registered users of Release 1A will be \$200. Lotus Development Corp., Cambridge, Mass.; (617) 577-8500.

Address Book Plus Adds Laser Printer Support

Channelmark Corp. is now shipping an upgrade to its *Pocket Address Software*. The new version, *Address Book Plus*, offers laser printer support and the ability to print address books and phone lists in four preset sizes. *Address Book Plus* is available in either a Senior Edition package with a 4½- by 7-inch cover or a Junior Edition with a 3½- by 5½-inch cover. Updates



Address Book Plus designs lists in four sizes.

are free to users who purchased after July 1, 1988, and \$25 for those who purchased prior to that date. New Senior and Junior Editions are \$84.95 and \$79.95, respectively. Channelmark Corp., San Mateo, Calif.; (415) 345-5900.



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COMMUNIQUÉS

edited by Bill Howard

We Couldn't Have Said It Better Ourselves

"The purpose of this manual is to aid the user of BCB's Tone-Talker hardware and software. From time to time changes may be made in this manual for purposes of clarification and updating this manual. These changes are subject to change without notice."

—User guide, BCB Electronics

Computer makers choose up sides

If computer manufacturers' computers are on the heels of us, men's Schindler said, "I think it is time to start the driving and give Microsoft a hand if I need them to drag their feet." Open Systems Foundation was not involved in the Open Systems Foundation and the Open Systems Foundation had been invited.

But AT&T has no in-

vention of plotting, but acknowledged that "there is a market" for AT&T's hardware.

Kayne said he would take steps to provide more and more open systems. Linux will always be open.

The record, Bremer, a ten-year-old, is among ten established in six cities: Tucson, Ariz.; New Orleans;

Jacksonville, Fla.; Kansas City, Mo., and Kansas City, Kan. A Bremer spokesman said the com-

pany will be used on both cellular and broadcast stations "but not in all the markets."

The nation's largest Hispanic television network, LatCom Group, recently agreed to drop Viacom and its 18 stations under

pressure from the Center for So-

cials, Kansas City, Mo., owns Cards Inc. of

Kansas City, Mo., and Kansas City, Kan. A Bremer spokesman said the com-

pany's revenue from liquor emporiums at its three major stations

at more than \$1 million a year.

Scrambled sectors? This story on the Open Systems Foundation in the Contra Costa County (Calif.) Business Times turned to drink in the last two columns.

The Official Borland Word Processor

Borland International, a rapidly growing software company, has an opportunity for a Publications Assistant . . . To be qualified for this position, you need to be thoroughly familiar with WordStar, have knowledge of PCs, and type 60+ wpm. We seek a quick learner who can take all there is to offer in this position."

—Classified ad, San Jose Mercury News, May 29, 1988

Amazing Facts

"OS/2 is the yet-unreleased new operating system for IBM's new line of personal computers, which will make full use of the memory and computing capacity of the Intel 80387 processing chip."

—Canadian Printer & Publisher magazine, July 1988

Coal-Bin Black, Velvet Black, Midnight Black, and 97 Others

"[MEC's Mass1 Draw] also provides interactive editing of text to stretch, pull down or pull up words, for instance. Plus 100 shades of black, six levels of zoom, and the ability to scan in and edit pictures or photos."

—Digital Review, July 11, 1988

A new networking solution has just come out of the woodwork.

And Fairchild Data Corp.'s solution is guaranteed termite-proof.

Is One Minor Problem, Comrade: Screen Shows Red Background Only

Software Products International announced plans to produce a Cyrillic version of its *Open Access II* software early next year and open a Moscow office.



Have you seen anything offbeat about the computer industry? If so, send your submissions to: Communications, PC Magazine, One Park Avenue, New York, NY 10016.

Winners this issue: Michel Hymoniz (COBOL reinvented), David Mayo (Borkend), Donald Krasnick (100 shades of black), Richard K. Jenkins (brickwork), Bernd Hansen (OS/2 & 80387), Khaled Saffouri (liquor foundation).

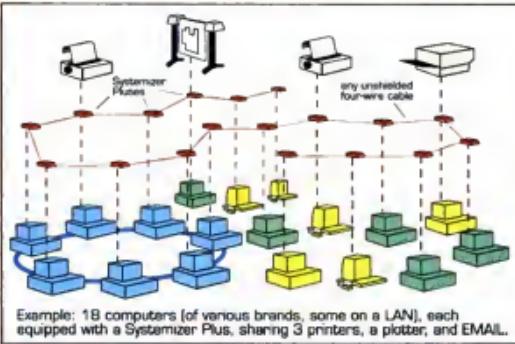
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Systemizing has become the connectivity standard at many of the world's largest corporations and throughout the federal government. Tens of thousands are already in use. The new Systemizer Plus is the latest model in Applied Creative Technology's line of Systemizing products, and it delivers what 95% of corporate computer users want from a Local Area Network—at far less cost and complexity, and yet with much more versatility.

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You can create stunning screens like this with FoxBASE+/Mac—immediately! This actual FoxBASE+/Mac screen photo illustrates the View Window, Command Window, Integrated Graphics, Memo field editing, Trace and Debugging Facilities, and the BROWSE feature.

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SUPPORT: THE STUMBLING BLOCK



Support is the bugbear of personal computers. You can buy them. You can install them. You can use them. But you can't get service for them. Or so it seems.

We get a lot of mail at *PC Magazine*. Most of our readers like what we do. They laud the comparison reviews, the technical columns, the benchmark tests. They like the way we rate products, and they like Editor's Choice. They have lots of suggestions about how we can do it better, too. We integrate them (at least the ones we agree with) on an ongoing basis.

One request, however, has me stymied. A surprising number of our readers want us to rate the quality of service and support on products. The sheer number of people who are asking for it tells me that service is a tremendous problem. The topic also has generated heavy message traffic on PC MagNet.

HORROR STORIES My in-box is filled with tales of woe. People often copy *PC Magazine* when they correspond in anger with a vendor. They're professionals, business owners, infocenter managers, doctors, lawyers, and lone users. (In an informal survey of responses, the lawyers get the best service. Nobody likes to be sued.) They complain about a broad range of problems: wrong ROM chips; slow software; recurrent hardware failures; inability to get simple questions answered; being put on hold for half an hour; incompetent sales, service, and support personnel; and upgrades.

Ah, upgrades. If there's anything that ticks a buyer off, it's selecting a product only to find that it's been replaced by a new version and that it's going to cost money to get the latest.

The software side of the business has this issue pretty much under control. The policies are well founded and have been around long enough to stand the tests of time, customer criticism, and sound business practice. Basically, the software companies announce a new product or version and specify a grace period. Any old-version product bought within that time is eligible for upgrade. The customer service reps handle the cases where buyers miss the deadline by a day, a week, or whatever. Sending bug fixes out to the entire registered user base isn't exactly an everyday occurrence, but it isn't unheard of either.

The hardware companies are something else again. The manufacturers take an approach that sounds suspiciously like "Don't call us, and we won't call you." You see, no hardware design is ever really finished. The design engineers hand it over to the production engineers. The software group keeps tinkering with the BIOS. And

the world's biggest beta-testing lab, the customer base, tries the engineers' combined handiwork on their real-world problems.

A company ships a new product or a new version of the old product. Slowly the phone lines begin to light up. It won't work with a Bernoulli Box. Someone's scanner works at 8 MHz, but not at 12. A new drive-type designation interferes with one already in use. It will read, but not format, 720K diskettes. I'm sure the earth would wobble on its axis if a computer manufacturer ever notified its installed base that there was a problem and here were the new ROMs the users needed to fix it.

I'm not just talking about small companies either. Microsoft doesn't support DOS ("It's not a Microsoft retail product"). IBM doesn't readily admit that you can plug in or connect anything that doesn't bear the IBM label ("We don't support untested configurations"). Compaq doesn't support anything ("Call your dealer").

RATE OR BERATE? The question is, How do we measure support? And how do we communicate it in a useful way to you?

In the review process, we are in continual contact with the manufacturers. Sometimes they know it's *PC Magazine* calling and sometimes they don't. Sometimes they put us on hold for half an hour. Other times they just give us quick, wrong information and hang up. Should we pass on our impressions of those contacts?

Remember that most of the time we're talking to the manufacturers when a prod-



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VIEWPOINTS

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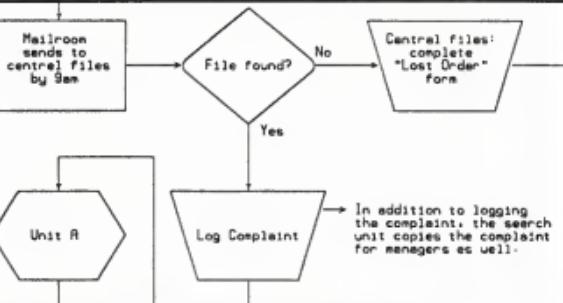
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uct is new. In some companies, such as WordPerfect Corp., that means that it's received considerable attention. In others, we get reactions like "You've got *WonderCalc* 9.0 already?!" Gee, I wish they'd give me a copy." Neither case is likely to be representative of the contacts you'll have. Newness can fade, and support with it. Belated support programs can pick up steam as the product goes into wider distribution. Bugs in the earliest versions of products are quickly resolved, and a reviewer's complaints may be dated in a few weeks or months.

My biggest concern is over the biggest variable: the human being at the other end of the phone. In fact, it's worse than that. The conversants at both ends of the phone are equally responsible, and sometimes equally culpable, for the quality of communication. I've talked to plenty of support people who spend the first 5 or 10 minutes just getting the caller calmed down enough to describe the problem. Some of the calls never get that far. And there are some support people who should be in some other line of work, such as programming or professional lawn maintenance.

Should *PC Magazine* tally and report the results of phone calls like these? What are the chances of our hearing about enough of the well-resolved support situations? When was the last time you dropped us a line to tell us that a Symantec or a Zenith was a terrific company?

SOMEWHERE OUT THERE Perhaps we should solicit conversations about companies and their support policies on *PC MagNet*. Then we could excerpt and report on our readers' real-world experiences. The downside, of course, is that *PC MagNet*, although enormous, acts like a focus group, both statistically and interpersonally. A strong personality can sway the opinions of others or cause the timorous to withhold their opinions, or even anger other users so much that they clam up. Of course, we can use our on-line survey capability to solicit opinions and experiences without the interaction, but then we'd miss the interplay and sharpening of opinions that take place in the discussion forums.

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■ JOHN C. DVORAK

THE DVORAK PROGRAMMERS QUIZ



Programming takes a special kind of person. A logical mind and a peculiar personality are key. To find out if you've got what it takes, take Dvorak's Programmers Quiz.

Microsoft, Borland, and others sell programming languages to computer newcomers by the score. While professional programmers account for a good portion of software vendors' income, most of the action comes from people who want to learn how to program and see if they like it. Some would-be programmers see the potential to make millions of dollars with that neat-o idea that has been bouncing around in their brains for the last couple of years.

Programming takes a special discipline and a logical mind, but it also takes a peculiar personality. The lifestyle of the best programmers is enviable. No set hours, good income, work always available. But there's that personality aspect to consider. To see if you're cut out for the job, take the Dvorak Programmers Quiz.

First off, let's bypass stuff like whether you like computers and the flexible hours and go into the real meaty questions.

Question 1: Which of the following beverages do you prefer?

- (A) Wine, (B) Jack Daniels, (C) Beer, (D) Jolt Cola

Question 2: How would you prefer to spend a leisurely Sunday afternoon?

- (A) Watching football, (B) Going to the zoo, (C) Playing Trivial Pursuit, (D) Testing batteries

Question 3: What is your favorite scent?

- (A) Yves St. Laurent Opium, (B) Oscar de la Renta, (C) Old Spice, (D) Pizza

Question 4: What do you like to wear as casual attire?

- (A) Sports coat, open shirt, (B) Slacks, Izod shirt, (C) Jeans, sweater, (D) Anything with a T-shirt

Question 5: What is your favorite food?

- (A) Tournedos Henri IV, (B) Coq au vin, (C) Hamburger, (D) Coffee

Question 6: What is your favorite noncomputer magazine?

- (A) New York Review of Books, (B) Time, (C) Playboy, (D) Batman

Question 7: What is your favorite scene in a movie or TV show?

- (A) Hamlet's soliloquy, (B) James Cagney's "I'm on top of the world, ma!" scene in *White Heat*, (C) Scene at end of *Dirty Harry* when Clint Eastwood says, "You've got to ask yourself: 'Do I feel



lucky?' Well . . . do you, punk?" (D) Spock's mind meld with a rock creature called the Horta. "The pain, the pain!"

Question 8: Who is your favorite actor?

- (A) John Gielgud, (B) Rod Steiger, (C) Bruce Willis, (D) Barney Rubble

Question 9: Who is your favorite actress?

- (A) Ingrid Bergman, (B) Meryl Streep, (C) Joan Collins, (D) Barbi Benton

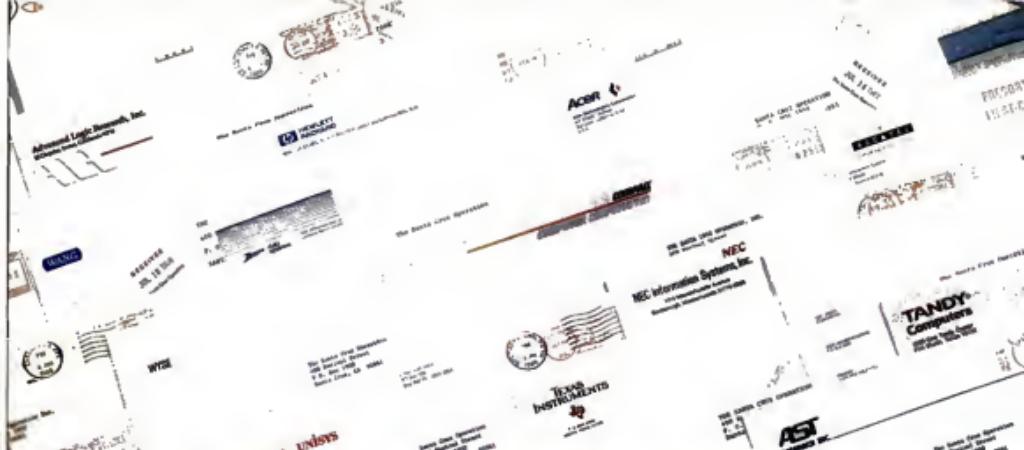
Question 10: What is your all-time favorite movie?

- (A) Ben-Hur, (B) A Passage to India, (C) Star Wars, (D) Fritz the Cat

Question 11: How do you think others perceive you?

- (A) As a person of taste and intelligence, (B) As an urban professional, (C) As a potential sex symbol if it weren't for your physique, (D) As God's gift to the 20th century, and rightly so.

Score 10 points for each answer D, 5 points for each C, and no points for any A or B. If you chose A for each question, then you're hopeless if you want to be a programmer. You have some potential as a COBOL programmer if you got 20-60 points. A score of 60-100 means you are headed in the right direction and should seek work at Microsoft to help you get your act together. 100 points or more says you have star quality. The sky is the limit. Good luck.



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■ JOHN C. DVORAK

INSIDE TRACK

486 chatter and an MS-DOS clone hit the streets

As the talk about the 80486 heats up, we are now hearing that IBM plans to hit the streets with an 80486 the minute the chip ships. Apparently they are designing a machine around the chip, using an emulator based on the specifications to which they are privy. Compaq also hints that it will be the first company with an 80486 machine. Is this power user blood lust or what?

It was years before the first 8080 machine was introduced, while the chip floated around. Then came the 8086. Nobody designed around it for years. The Seattle Computer Products DOS was developed long before IBM announced the 8088-based PC. The 80286 also sat on the designer's table before acceptance into the computer community. The key thing with the 80286 was that it didn't hang around as long. It marked a new trend: quick implementation. It was within a year of the first shipped 80386 that machines appeared. Now we expect to see the new chip and machines appear at the same time.

It's not as though we really need this much power on a desktop. It's a basic need for anything new to keep the marketing juggernaut moving at a fast and furious pace. All that's really happening in the industry is faster and faster chips. Where's some software to go with it?

I'm now staring at machines right on my desk containing 80386 chips and 68020 chips. Sheesh. 68030 and 486 machines are already in the planning stages. Now I can run that program that plots a NASA probe launch to Neptune.

DOS 4 One and 4 All Dept.: Can't IBM do anything right? This operating system is their baby, and it has so many bugs that we're told that we can expect to see 4.1 sooner than expected. I'd wait for 4.2 the way they are going.

Cute Product, Cute Idea Dept.: If you want to see a cute product, then look at DR-DOS from Digital Research. I've been meaning to compliment DRI for this bold new product: an MS-DOS clone designed to be inexpensively licensed to OEMS as a replacement for DOS 3.3. It looks pretty nifty to me! It ran everything I threw at it, including some bizarre games. When I ran V Bench from Golden Bough Systems, it showed a dramatic efficiency increase over DOS itself. The performance-minded should take note.

DR-DOS is ROMable, unlike MS-DOS; this should find use in laptops, where disk access chews up batteries. The closest anyone has come to a ROMable DOS is Toshiba, which has DOS 2.1 in ROM loaded onto a permanent RAMdisk. A kludge way to do it.

There doesn't seem to be much of an end-user market for DR-DOS. Most end users with new clones simply find a friend with MS-DOS and bootleg it.

This sad truth does not encourage anyone to clone DOS. When the Radio Shack operating system, TRS-DOS, was cloned years ago, the key was supersets. Newdos and the other clones added features not available in plain-vanilla TRSDOS. This is the key to success. The long-term problem, of course, is that at some point you can't stay 100 percent compatible as the laggard vendors (Microsoft and IBM, in this case) add the same new features but with different command structures. So nobody in this business wants to even try to make a go of it.

So congrats to DRI for doing what it did. Now here's a product idea for someone. Put the DR-DOS in ROM on a short card with the necessary support chips, so that the big machines boot right

to the operating system with the flick of a switch. No disk access, skip the hokey and useless memory check, just go right to the C prompt. This is not a new idea. The old (circa-1977) SOL-20 used to have a ROM operating system that came right up. When they upgraded the operating system, you swapped the ROM out. No chance for casual bootlegging here.

With larger memory and upcoming monster operating systems, it's apparent that we have to rethink the start-up procedure. Most users are not going to leave their machines on overnight. When they come in, they don't want to wait an eternity for it to check 16MB and then to boot. When something crashes the system, they don't want to wait forever for a reboot, either. With DOS (or OS/2) on a ROM and diagnosis done by the user monthly when the user, say, optimizes the disks, you'll have instant on. Wham, Bam, thank you, DOS!

Somebody Has to Complain Dept.: Has anyone tried using the on-line airlines flight reservation systems, namely Electronic OAG and Easay Sabre? They stink. I realized this when, for the umpteenth time, I called my travel agent, Dottie, and she immediately found a near-perfect and obvious connection that wasn't listed on either system. This was a flight from San Francisco to Taiwan via Tokyo. Easay Sabre suggested that I fly to Los Angeles, then to Toronto, and then to Taiwan! Yeah, right! How about San Francisco to Los Angeles to Seattle to Taiwan? That was another connection they listed. Give me a break.

Easay Sabre, a service of American Airlines, is clearly the worse of the two systems. While both systems insist on using an arcane 40-character display, Easay Sabre uses no common sense with its display and, overall, it's completely unusable. An incredible dog. This is a good idea, and it's a shame that it can't be done right. I have to rely on the little OAG books for information.

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■ JIM SEYMOUR

THE DECLINE OF THE MICRO MANAGER



Micro managers may be losing the magic touch as in-house systems developers enter the scene. Soon, PC-based strategic systems and their promoters will take center stage.

The way American corporations view and manage their computer resources—in particular, how and why they purchase and distribute PCs—is changing dramatically. At the same time, a fundamental shift of power is under way.

The "micro manager"—fabled in song and story as the person who brought order to the chaos that was the rule when corporations first brought lots of PCs—is becoming much less important. From a primary and highly visible role as a planner, gatekeeper, standards setter, cheerleader, support manager, and more, today's micro manager is becoming just another middle-level office-services manager.

It's still important to buy PCs and software in a cost-effective way. It's still important to evaluate and recommend new software and hardware. It's still important to run the occasional training class and provide some kind of continuing applications-software support and fast hardware fixes. All those things remain in the micro manager's job description. And because those functions continue to be important to a smooth-running operation, neither the micro manager nor that job description is going to disappear in most companies.

But the job has lost its edge—that buzz of excitement from being at the forefront of a small revolution. Today, micro managers say their work has become tedious and routine. And as much as many might have longed for some tedium and routine in the manic days of 3 and 4 years ago, they're not happy with it now. Because being a micro manager isn't "where it's at" in PCs in today's corporation. Increasing-

ly, the high-visibility, leading-edge personal-computer-related job is that of the corporate in-house PC systems developer (IHSD for short).

Two fundamental and irreversible trends are stripping the pizzazz away from the micro manager—who becomes little more than a purchasing agent and spares-inventory manager—and edging the micro manager's former mantle onto the shoulders of the IHSD in many companies.

NEW STRATEGIES The first trend—and the more powerful in the near term—is corporate understanding of the importance of strategic planning. Despite the claims of some name-brand business gurus, this shift is not their creation, nor is it entirely new.

For years, a big oil company called (among other things) Esso/Humble had focused on selling gasoline to automobile

owners. In the 1960s, Esso looked at its future and decided that if it wanted to be as important in the 21st century as it had become in the 20th, it had better start thinking of itself as an *energy* company, not just a gasoline refiner and distributor. From that fundamental shift in perception came not only a name change to Exxon but also a company now vastly stronger, wealthier, and healthier.

That kind of strategic thinking—"Just what are we up to here? Where are we going? How can our capital investments advance that strategy?"—has led many corporations to begin seeing PCs as a lot more than just fast typewriters and calculators. By using PCs as delivery platforms for *strategic systems*, companies are expanding the role of the desktop computer, moving it away from record-keeper and bean-counter toward becoming a competitive tool.

These strategic systems range from market- and currency-tracking systems or automated order-entry systems that sit on customers' desks to new systems for delivering information services to customers. In general, they can be seen as offensive, not defensive; as market-driven, not administration-driven; as ways to *make money*, not ways to save money.

A SHIFT IN SCALE The second trend now becoming visible—and in this context the more powerful long-term trend—is a move toward "downsizing." Remember that word: you'll be hearing it a lot over the next months and years. Downsizing is that corporate push to replace older, larger sys-



Illustration: L.M. Hirsch

■ JIM SEYMOUR

tems with newer, smaller ones that are better suited to the work at hand. The most obvious and most widely debated example is the move away from terminals tied to minis and mainframes in favor of PCs con-

nected through local area networks.

When a year and a half or so ago, some of us began talking seriously about LAN-based PCs as real alternatives to mainframes for some work, the hoots of deri-

sion were loud. Now, many of those skeptics are becoming believers—or at least, they're venturing out of their glass houses to see how colleagues at other companies have managed this transition so successfully.

In the most literal sense, downsizing guarantees the prominence of the IHSD. As there are fewer big-iron systems and more micro-based ones, more systems development work will be done on PCs, to be delivered on PCs.

But the issue is larger.

The resident processing power of PCs makes them vastly superior platforms for distributed-processing systems. Because

■ The micro manager's job has lost its edge—that buzz of excitement from being at the forefront of a small revolution. Today, the work has become tedious and routine.

there are already a lot of PCs in place—and a lot of people familiar with them—in corporations, systems delivered on PCs may be cheaper to put in place, and they'll certainly be more readily accepted. Both are important tests.

If we're to replace the vast, centralized power of the mainframe with the collective power of many far-less-powerful PCs in LANs, systems developers have to push as much processing as possible onto those desktops. And if companies are to be able to move quickly enough with new strategic systems to seize the moment—moments of competitive advantage that are increasingly fleeting and evanescent—those systems must be delivered on platforms already widely accepted.

In this column, we'll look from time to time at some of the issues facing in-house PC systems developers, and how they're changing the role and focus of MIS.

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PC Magazine
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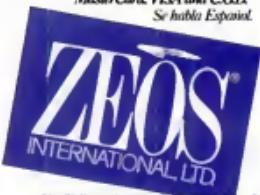
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■ STEPHEN MANES

DESKTOP PUBLISHING: CAN YOU JUSTIFY IT?

In the right hands, page-makeup programs create stunning typographic power for a reasonable price. In the wrong ones, they create wrestling magazines.

I don't do crack. I don't do heroin. And I don't do desktop publishing.

Type is sneakily addictive and has been for hundreds of years. The pursuit of typographical perfection seems almost ingrained in human nature. Even before the advent of movable type, scribes gussied up their pages with ever-improving letter forms and stunning illuminations—to the point where early printed books were looked upon as second-rate imitations. Printers won a burgeoning array of typographic improvements—and lower prices.

Typography seduced Samuel Clemens into bankrupting himself. "Eureka!" he exulted in 1889. "I have seen a line of movable type, spaced and justified by machinery! This is the first time in the history of the world that this amazing thing has ever been done."

His investments in the Paige typesetting machine proved less well justified. By 1894, when the first Paige was finally installed (unsuccessfully) in a newspaper office, the Linotype—working on an entirely different principle—had already revolutionized the world of printing, and Mark Twain was broke.

MUCKRAKING MASTERPIECE My personal addiction began with my elementary school newsmagazine. Although the only tools this mimeographed muckraker had were a typewriter for text, stencils for headlines, and stylus for drawing, our hard-nosed faculty adviser insisted that the *Sunnyside Review* be set in three right-justified columns.

So first we typed all the articles to the of-

ficial column width, filling out unjustified lines with asterisks. Next we dutifully marked up each article, translating asterisks into red numbers showing where and how many extra spaces should appear between each word to justify each line. After we dummed pages from these marked-up columns, a crack secretary in the principal's office would type mimeo masters to match. The result looked less like a real magazine than a very unusually typewritten set of 8½ by 11-inch sheets. We, of course, thought it looked great.

The college film mag I used to edit dispensed with justification on the theory that many graphics specialists deemed it unnecessary; besides, it was a pain to do. But in order to get that "typeset" look, we produced our text on the one-and-only low-cost producer of proportional spacing, the IBM Executive typewriter, and made headlines with transfer type—neither of which could have fooled a practiced eye.



for even a fraction of a second. We, of course, thought it looked great.

TRULY TYPESET Today's page-makeup software can get you far closer to a "truly typeset" look, but often it works much the same way. Put in a lot of time and effort; when you're done, you, of course, think the result looks great.

Even if it doesn't. Which is fine for a church gazette or the Zwiebelfleisch Familiy Blatt. Although in theory desktop publishing makes it possible for almost anyone to turn out professional-looking pages, desktop publishing, in truth, makes it possible for professionals to turn out professional-looking pages.

Designing pages is a skill. It may not be as hard as hitting a major league fastball, but a look at the ugly mugs of magazines and newspapers at your local 7-Eleven (journals of wrestling are particularly instructive) should convince you that it's not exactly an inborn talent. Unless you're at least a very accomplished amateur, going hands-on with a desktop publishing program is better considered a recreational pursuit than a rational use of productive time. So you're likely to end up hiring a pro to do it for you.

CAVEAT EMPTOR Since desktop publishing programs make it possible for anybody with a computer and a laser printer to set up shop as a typographer or graphics designer, your project may become a learning experience—not to mention a teaching experience, as you attempt to convey typographical tradition to those



■ STEPHEN MANES

other users who learned their craft from a software manual.

One advantage of using page-makeup software is money. The price of type ends up being a lot lower than traditional type-

setting. But often the lower price gets you lower quality as well—fuzzy characters from a laser printer instead of sharp letters from a real typesetting machine.

The elimination of rekeying is another

bonus. If somebody types it on a computer, chances are the keystrokes can be turned directly into type—thereby avoiding a major source of error.

An even bigger advantage of page-makeup software is the ability to fix problems on the spot. Alas, though strange things can and do occur, proofreading for composition errors—a traditional task among typesetters—is uncommon in the desktop publishing trade. Result: It's entirely your responsibility to make sure funny things haven't crept in.

Which, of course, they always seem to do. Take the em-dash dilemma. Since there's no official ASCII convention for em dashes—the extra-wide ones surrounding these words—it's not always clear how to enter them with a word processor. Result: How they're printed depends on the operator's mercy.

In a set of galleys for one of my recent books, all em-dashes vanished. In their stead appeared hyphens followed by periods, hyphens alone, doubled hyphens, you name it. Much red-pencil work and a couple of resets later, everything was set almost right.

Columnar material has always been a typesetter's nightmare. It still is. Columns have a way of moving around as though they had minds of their own. With most page-makeup software, getting the alignment right in print can be difficult even when it looks fine on the screen. Often the culprits are tab stops and spaces, which may seem identical on the screen—but not on the page.

When the typesetter transmits the pages via modem and has them printed in a remote city without bothering to look at them first—as happened recently with another of my books—the result is The Endless Resetting Waltz.

And that's just the first of many sad songs. Still, for those who need it, desktop publishing software really can save money and, often, time. It has already begun to revolutionize the way we use type. But for now, the real-life problems are worth keeping in mind. Maybe even if you run a wrestling rag.

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CIRCLE 471 ON READER SERVICE CARD

PC MAGAZINE ■ NOVEMBER 29, 1988

*Contributing Editor Stephen Manes is the author of the recent *The Complete MCI Mail Handbook* (Bantam).*

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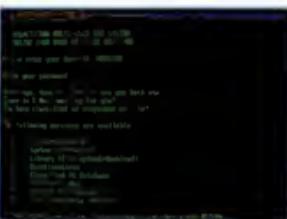
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THE PERSONAL SYSTEMS MAGAZINE

May 1988

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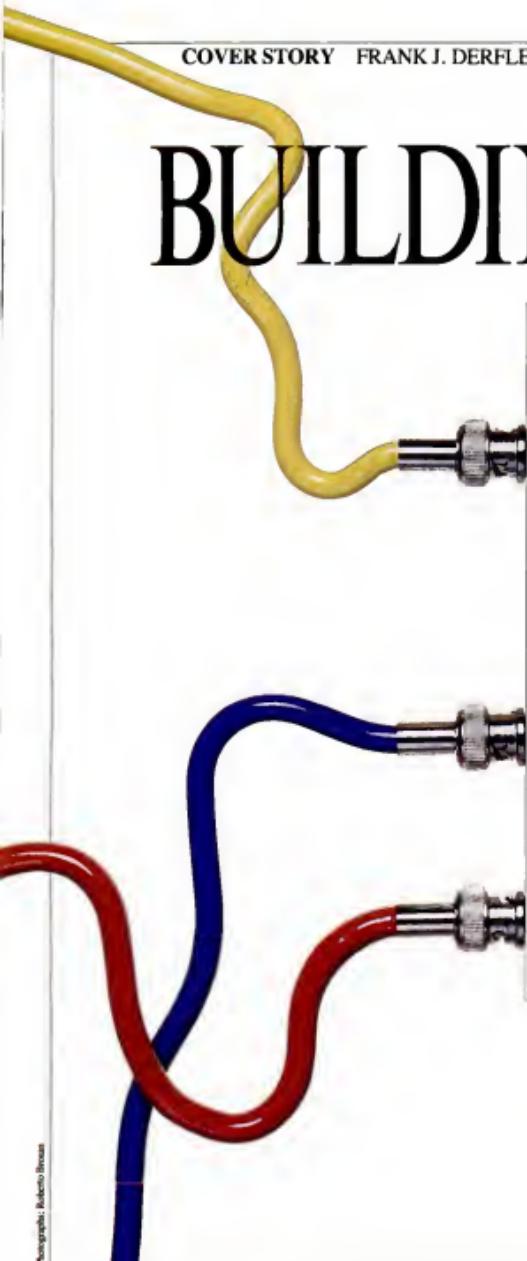
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BUILDING WORK

LAN GATE

► In the best of all possible worlds of PC/mainframe coexistence, the PC serves as a window into the corporate information environment of the mainframe. True, entry into this optimal world has been attainable ever since DCA's introduction of the IRMA card. With IRMA—or any of its competitors' products—installed, PCs can double as IBM mainframe terminals. And the mere touch of a key toggles you between local DOS programs and mainframe processes. You don't even have to consider the use of separate PC and mainframe terminals or, especially, having to rekey the data in order to share it between them.

As always, however, increasing technical sophistication has made us hungry for something better. The problem with coaxial



Photograph: Roberto Borsari

GROUP SOLUTIONS

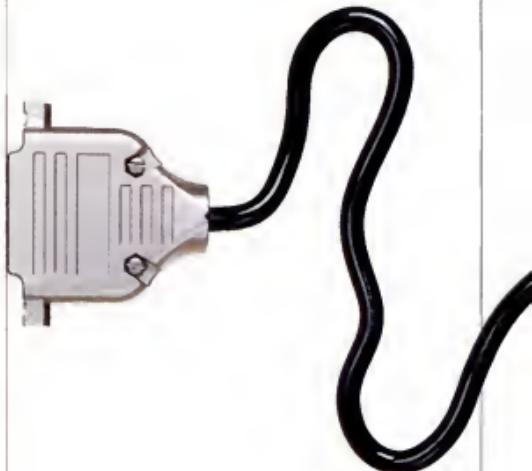
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PART · 1

ally connected products like IRMA is that they require each PC using them to maintain a dedicated—and expensive—link to the mainframe, even if that connection is used only sporadically.

If your firm has installed a local area network to allow your PCs to share data files and peripheral devices, you have another option: Why not use the LAN to share expensive links to the mainframe system? LAN gateways establish a por-

Gateway LANs from Banyan and Harris create a portal that lets PC workstations share expensive mainframe connections through a single link.



■ LAN GATEWAYS

tal that allows all connected stations to access the mainframe through a single link.

APPROACH TO GATEWAYS *PC Magazine's* two-part series on gateways, which continues in the next issue, limits its coverage to gateways using the IBM Systems Network Architecture (SNA) protocol, the fastest-growing mainframe connection scheme. All products tested emulate an IBM 3274 cluster controller attached to the mainframe through a front-end processor by means of a 19.2-kilobit-per-second RS-232C link.

In this issue, we review two proprietary bundled systems, Banyan Systems' Corporate Network Server and Harris Corp.'s 9300 Network Communications System. Both are complete local area networks with gateway services built into a dedicated file and print server. The next issue will include a look at a dozen open systems: generic add-in LAN gateways that can reside in nearly any PC or nearly any modern PC-based LAN.

If you need to link PCs to IBM mainframe systems and already have a LAN installed, look at the add-in gateway products we review in the next issue. If you don't yet have a LAN or are unhappy with what you do have, the Harris or Banyan products can give great service with plenty of room to grow.

A NEW LOOK *PC Magazine* has reviewed Banyan's VINES operating system several times (see "A Field Guide to LAN Operating Systems," June 14, 1988, for the most recent review), but none of these reviews focused on the VINES gateway services. New in this review is a description of Banyan's latest software release, Version 3.0 of VINES, along with Banyan's new Corporate Network Server, which is based on the 80386 processor.

The Harris 9300 Network Communications System is a fine LAN server, but *PC Magazine* has not previously reviewed it in that capacity. It would have been unfair to look at only the LAN portion of this powerful product without considering its gateway functions.

The two systems are similar in their technical and physical designs, and both have in common a network operating system based on Unix. But even though each



If you don't yet have a LAN or
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has a server that runs a Unix-based system, it understands and emulates DOS when communicating with the workstations. While the Harris 9300 System makes the Unix system more visible by requiring the use of Xenix, the Banyan Corporate Network Server hides Unix from all but those with factory-authorized passwords. In both cases, Unix furnishes important multitasking capabilities.

In terms of hardware, each system consists of a floor-standing computer that can continuously operate several high-capacity hard disk drives, a tape backup unit, several printer and communications ports, and many megabytes of internal memory. Both the hardware and the LAN operating systems used in these products are "commercial grade"—their performance, in other words, rates at the upper limits of all LAN systems.

NO EASY INSTALLATION Installing any LAN gateway requires collaboration between the LAN system administrator and folks with special skills on the mainframe end—the systems programmers. People on both sides of the link must set numerous electrical and software parameters to ensure effective terminal operation and file transfer through the gateway. While the software does contain menus to make life easier, the initial installation and configuration for both systems takes the full attention of someone who has complemented a good practical knowledge of MS-DOS with a 3- to 5-day vendor-run course on the LAN software.

The advantages of systems like the two reviewed here are that they're tightly integrated and bundled. They're supported by a single vendor. Options for adding communications capabilities and interfaces to other types of computers and networks are predesigned as well.

The gateway systems to be covered in the next issue are more flexible. But while you can push them into existing networks made up of products from several different vendors, you risk incompatibility. So the choices aren't easy.

GATEWAYS AND BEYOND What's needed, perhaps, is a fuller explanation of where gateways fit in with other methods of PC-to-mainframe communication

through the Systems Network Architecture (SNA). The remainder of this introduction to the Banyan and Harris systems will be devoted to a tutorial—skip ahead if you're no stranger to the subject.

Before a PC and an IBM mainframe can communicate through the SNA and transfer data between each other, some major obstacles must be circumvented. The usual way of communicating with such a mainframe is through an IBM 3278 or 3279 terminal (generically known as a "3270" terminal). But the PC's keyboard doesn't have as many keys as a 3270 terminal does, and the terminal has several special graphics characters that aren't in the PC's screen repertoire. The PC also lacks an appropriate communications interface and uses the ASCII data alphabet instead of IBM's mainframe standard, EBCDIC.

There are presently three basic ways to overcome these difficulties: by adding a plug-in card combined with software and/or hardware and making the PC act like a 3270 terminal (IRMA-type solutions); by connecting a protocol converter between the PC and the mainframe that translates the mainframe's data into a form usable by the PC; or by using a gateway LAN.

KNOW YOUR NUMBERS Any article that explains how to hook PCs to IBM mainframe computers has to deal with a lot of IBM equipment numbers and describe the IBM network architecture schemes. To begin, IBM's major line of terminals, printers, and other communications devices falls into the general category of the "3270 family" of equipment. Each type of device has a specific model number (many, but by no means all of which, begin with the digits "327"). They're all designed to work in concert to orchestrate users'—both of PCs and other equipment—access to the computing power of the mainframe. Well over 2 million 3270 family terminals are in use today.

IBM's Systems Network Architecture is its grand scheme for connecting its myriad 3270-family products. It is a flexible protocol and can be configured in several different ways. Here's how the 3270 family of products fits into various SNA set-ups.

In a classic 3270 system, each 3278 or 3279 terminal connects to a 3174 or 3274



Keyboard Definitions: IBM 3270 vs. IBM PC

Users plagued by dizzying PC keyboard variations face an even greater challenge before the IBM 3270 terminal keyboard. This chart, adapted from a Banyan terminal emulation software help screen, notes the PC keystroke combinations that emulate keys on the 3270 keyboard.

IBM 3270	IBM PC	IBM 3270	IBM PC
Alt cursor	Alt-F5	pf4	Alt-4
Attn	F1	pf5	Alt-5
Backspace	Backspace	pf6	Alt-6
Backtab	Backtab	pf7	Alt-7
Cancel	Alt-F10	pf8	Alt-8
Clear	F2	pf9	Alt-9
Command	F3	pf10	Alt-0
Cursor sel	Alt-F2	pf11	Alt-
Delete	Del	pf12	Alt-=
Down	Down Arrow	pf13	Alt-Q
Dup	Ctrl-G	pf14	Alt-W
Enter	Enter	pf15	Alt-E
Erase eof	F6	pf16	Alt-R
Erase input	F4	pf17	Alt-T
Flip	F8	pf18	Alt-Y
fm	Esc	pf19	Alt-U
Home	Home	pf20	Alt-I
Hotkey	Alt-Z	pf21	Alt-0
Insert	Ins	pf22	Alt-P
Left	Left Arrow	pf23	Alt-A
Left 2	Ctrl-D	pf24	Alt-S
Nextline	F9	Print	F7
pa1	Ctrl-J	Reset	F10
pa2	Ctrl-K	Right	Right Arrow
pa3	Ctrl-L	Right 2	Ctrl-F
pf1	Alt-1	Sysreg	Alt-F1
pf2	Alt-2	Tab	Tab
pf3	Alt-3	Up	Up Arrow

terminal cluster controller through coaxial cable. The cluster controller acts as a concentrator by gathering messages from the terminals for more-efficient transmission to the mainframe.

Groups of cluster controllers attach via a telecommunications line (which can run a few hundred feet locally or even across the country, through leased telephone lines and modems) to another larger device

called a communications controller or a front-end processor (FEP). The common IBM front-end processors are models 3705 and 3725. Other companies, such as ITT Courier, Telex, and Lee Data, make products that are "plug compatible" and compete with IBM's 3270 devices.

In a relatively recent evolution of the classic plan, IBM gave the 3174 terminal controller, the 3725 FEP, the 3745 com-

A GLOSSARY OF NETWORKING TERMS

ASCII American Standard Code for Information Interchange. The data alphabet used in the IBM PC that determines the composition of the 7-bit strings of zeros and ones representing each character (alphabetic, numeric, and special).

Bisync Bisynchronous Communications. Also abbreviated as BSC, this protocol is one of the two commonly used methods of encoding data for transmission between devices in computer systems. Data characters are gathered in a package called a frame that is marked by two (bi) synchronization bits. The more modern protocol is SDLC.

CICS Customer Information Control System. This software from IBM runs on the mainframe and makes a variety of services available for application programs. It furnishes easy ways for programs to enter and request data in mainframe files.

Cluster Controller A computer that sits between a group of terminals and the mainframe, gathering messages and clustering them for more efficient transmission to the mainframe.

DISOSS Distributed Office Supported System. An integrated package of electronic mail and document preparation programs from IBM designed for IBM mainframe computer systems.

EBCDIC Extended Binary Coded Decimal Interchange Code. The data alphabet used in all IBM computers except the

PC that determines the composition of the 8-bit string of zeros and ones representing each character (alphabetic, numeric, and special).

FEP Front-End Processor. A computer that sits between groups of cluster controllers and the mainframe, concentrating signals before they are transmitted to the mainframe.

Gateway A shared portal from a local area network into a larger information resource such as a large packet-switched information network or a mainframe computer.

IND\$FILE A mainframe editing utility commonly used to make PC-to-mainframe file transfers.

LU A Logical Unit in an SNA network that addresses and interacts with the host. Typically in a LAN gateway system, an LU is analogous to a session, a terminal-to-mainframe connection.

NCP Network Control Program. This special IBM software runs in the front-end processor and works with VTAM to link the host computer and terminal controllers.

PU A Physical Unit in an SNA network, usually a terminal or printer, connected to the controller.

RJE Remote Job Entry. A method of submitting work to a mainframe in a batch format. Though superseded by the 3270 system, it is still widely used in some installations.

RU Request Unit or Response Unit. A message that makes a request or responds to a request during a session.

SDLC Synchronous Data Link Control. An essential part of SNA, SDLC is a more efficient method than the older bisync protocol when it comes to packaging data for transmission between computers. Packets of data are sent over the line without the overhead created by synchronization and other padding bits.

Session The name for the connection between the PC emulating a mainframe terminal and the mainframe itself when they are communicating. The number of sessions that can be run simultaneously through a LAN gateway is limited by the gateway's software and the hardware configuration.

SNA Systems Network Architecture. IBM's scheme for connecting its computer products so that they can communicate and/or share data.

3174 A new version of the 3274 terminal cluster controller.

3270 The generic name for the family of interoperable IBM system components—terminals, printers, terminal cluster controllers, and mainframe front-end processors—that can be used to communicate with a mainframe using the SNA protocol. All of these components have four-number names, some of which begin with the digits 327.

3274/6 The most commonly used clus-

munications controller, and other devices the ability to become nodes on a Token-Ring Network. This eliminates the need for a coaxial cable connection between each PC emulating a terminal and the controller, but it requires relatively expensive adapters and more memory on the 3270 hardware. Introduction of the high-speed 16-megabit-per-second IBM Token-Ring Network this year will require yet another equipment upgrade.

PUs AND LUs In IBM's SNA connection scheme, each terminal or printer connected to the controller is called a physical

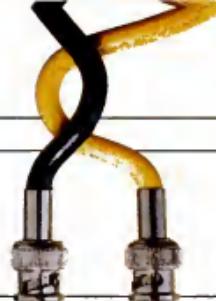
unit, or PU. There are different kinds of PUs with different capabilities. The front-end processor expects to get specific kinds of responses and to send certain kinds of data from and to each type of PU.

Each PU holds one or more logical units, or LUs; these address and interact with the host in an SNA network. It is actually the LU, typically a program, that does the work that's transmitted over the communications link. IBM's Virtual Telecommunications Access Method (VTAM) software, which runs in the mainframe, works with the Network Control Program (NCP) in the front-end processor to recog-

nize, configure, and communicate with the LUs.

During operation, the 3278/9 terminals send messages called scan codes to the cluster controller each time that a key is pressed. The cluster controller echoes the keystrokes back to the terminal so that they are confirmed and displayed on the screen. Data from the mainframe host goes in steps through the front-end processor, to the cluster controller, and into a display buffer in the terminal.

Data coming to the terminal for screen presentation is handled in blocks called fields; these can vary in length from a few



ter controller. This device links as many as 32 3270-type terminals and printers to a mainframe front-end processor.

3278 The most commonly used terminal in the 3270 family. It features a monochrome display and offers a limited graphics set.

3279 A color terminal that's part of the 3270 family.

3270 The current series of printers in the 3270 equipment family.

3705 A commonly used front-end processor, typically used to link several 3274s to a mainframe.

3725 A commonly used front-end processor, intended for linking groups of cluster controllers to the mainframe.

3745 A new communications controller that combines the functions of a cluster controller and a front-end processor. The 3745 can interface simultaneously with as many as 8 token-ring networks, 512 terminals/printers, and 16 1.544-megabit-per-second communications lines.

VTAM Virtual Telecommunications Access Method. This software runs on the host mainframe computer and works with the Network Control Program to establish communications between the host and the cluster controllers. Among other things, VTAM sets the pacing and LU characteristics.

X.25 A CCITT standard that describes how data is handled in a packet-switched network.—Frank J. Derfle, Jr.

characters to a whole screen. The size and characteristics of the field depend on what the terminal finds in the display buffer. Characteristics like blinking, reverse video, seven-color displays, and underlining are defined by modified characters containing extended attribute bytes. These bytes give different meaning to EBCDIC characters to let them represent functions not ordinarily handled in the 8-bit-data alphabet the 3270 terminals use.

EASY TRANSFERS Simple file transfers between a PC and mainframe are often done using an IBM editing utility on the

mainframe called IND\$FILE. This method of moving data is effective, but it's slow. Companies like Linkware Corp., VM Personal Computing, Micro Tempus, Mackensen Corp., and others sell software for both the PC and host that speeds file transfers between them.

Making mainframe data easily available to PC applications is another task for paired PC-host software. Companies as diverse as Lotus Development Corp. and Martin-Marietta market software for the PC that extracts data from mainframe systems for PC applications.

BANYAN SYSTEMS INC. Banyan Corporate Network Server

The June 14, 1988, issue of *PC Magazine* (page 182) looked at the *VINES* operating system running on a 32-bit Banyan server powered by a Motorola 68000 processor. This review covers Banyan's latest release of *VINES*, Version 3.0, used with the 80386-powered Banyan Corporate Network Server (CNS).

The Banyan CNS is a dedicated machine that requires a separate terminal connected via RS-232C to control and monitor the *VINES* operating system. *VINES* is based on Unix, and each separate feature of *VINES*, like electronic mail or 3270 communications, runs as a separate task in the server.



FACT FILE

Banyan Corporate Network Server

Banyan Systems Inc.
115 Flinders Rd.
Westboro, MA 01581
(508) 898-1000

List Price: \$23,795 (with 4MB RAM,
80MB hard disk, and *VINES* 3.0); other configurations available.

In Short: A powerful local area network operating system and server designed around the 80386 processor. The new version of *VINES* brings in new management tools, the ability to have networked printers on workstations, and improved performance. Particularly strong communications capabilities.

CIRCLE 600 ON READER SERVICE CARD

As the benchmark tests

demonstrate, Banyan's *VINES*

3.0 for 386-based machines is

no clinging vine: it moves!

VINES BACKGROUND Our previous reviews of *VINES* have detailed the power and flexibility of this software. The program automatically configures itself to work with network interface cards from a wide variety of manufacturers. Its excellent management features plus a statistical reporting package called Netman present a clear picture of network performance as well. *VINES* has strong communications capabilities, including remote dial-in and server-to-server connections over X.25 packet-switched networks and wide-area networks using leased telephone lines.

VINES 3.0 is a new adaptation of the operating system for 386-based machines. A version of *VINES* was available for 80286 machines, but it wasn't strongly marketed by Banyan because of performance. As the benchmark tests show, *VINES* 3.0 is no clinging vine: it moves!

Previous benchmark tests of *VINES* showed that the system slowed disproportionately in our small-block-size (512-byte) transfer exercise. LAN tasks like file transfer and print spooling are done in larger, more economical block sizes. Small data blocks are used when databases and other multiuser programs share files. *VINES* 3.0 did significantly better in small-data-block transfers than previous versions of the program have done.

BANYAN'S CNS The Banyan Corporate Network Server is a floor-pedestal computer about 25 by 10 by 26 inches (HWD); it weighs 80 pounds. The CNS can hold a combination of 80MB, 146MB, and



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■ LAN GATEWAYS



The Connectivity Decision Guide

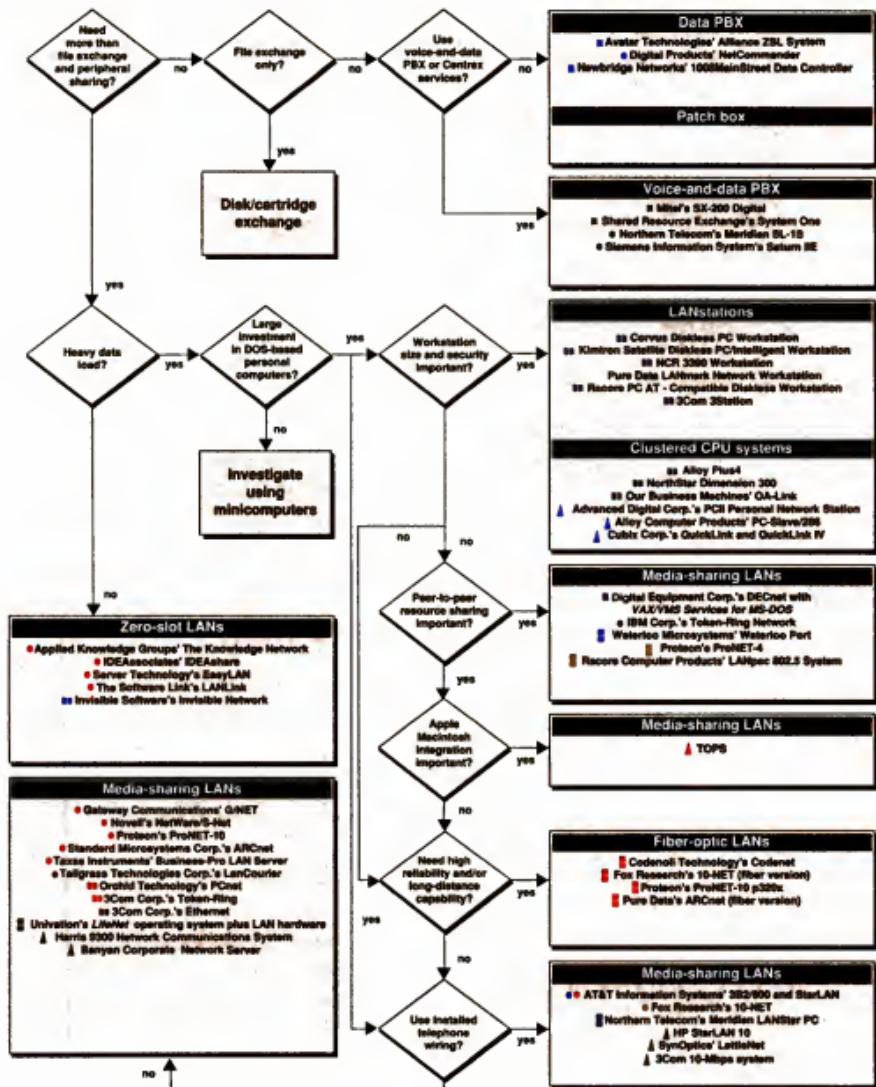
This chart is designed to help you select from among the many information-transfer and resource-sharing alternatives. As you can see on the chart, if all you really need to do is exchange files or share printers, then you should consider devices such as PBXs and patch boxes. If your organization has not already invested heavily in PCs or DOS programs, then a minicomputer might meet your needs more economically. But if you want many users to share data files simultaneously under DOS, a LAN may be the best alternative. Once you've decided on a LAN, the need for station-to-station resource sharing and other factors will influence your network purchasing decision.

Because manufacturers include many different features in their networks, some products will not fit neatly into one decision box in this guide. You'll also find that the lack of differentiation between LANs is becoming as large a problem in the LAN industry as the lack of standards was 2 years ago. But overlapping features and technical similarity between networks are good news for potential buyers. They will let you concentrate on more-traditional factors such as dealer support and price instead of on more-technical considerations.

Reviews originally appeared in
PC Magazine:

- December 9, 1986
- December 23, 1986
- January 13, 1987
- January 27, 1987
- February 10, 1987
- February 24, 1987
- March 31, 1987
- April 14, 1987
- May 26, 1987
- June 9, 1987
- June 23, 1987
- July 1987
- August 1987
- September 29, 1987
- October 27, 1987
- January 12, 1988
- January 26, 1988
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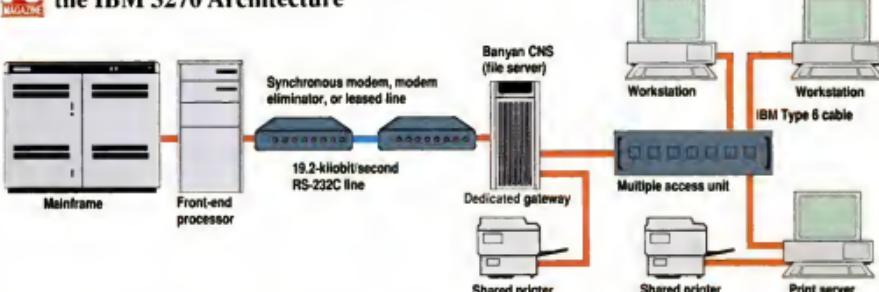
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CIRCLE 136 ON READER SERVICE CARD

■ LAN GATEWAYS



The Banyan CNS as a Gateway into the IBM 3270 Architecture



The Banyan Corporate Network Server (CNS), a dedicated gateway, can hold a combination of 80MB, 146MB, and 300MB disk drives and a 150MB streaming tape system without an external chassis. Here, the CNS links a mainframe with a shared printer and

a multiple access unit (MAU). The MAU acts as a hub connecting the Banyan CNS and up to seven workstations; when several MAUs are connected, the potential number of linked nodes is greatly increased.

300MB disk drives and a 150MB streaming tape system for both backup and loading of the operating system. If you use an external chassis, you can access up to 2.5 gigabytes of disk storage. You can put up to 24MB of memory into the CNS to feed its 20-MHz 80386 processor.

Cards inserted into seven AT-compatible expansion slots handle connections for communications ports and up to four separate networks. A built-in SCSI bus controls data-storage peripherals. You can also attach up to seven local printers through the four serial and three parallel printer ports, which do not interfere with the communications ports.

One nice touch is that every Banyan Corporate Network Server contains an integrated battery backup (now you know where the 80 pounds comes from) that notifies users when the server loses power, then gracefully shuts down—only after closing all open files. When the server's power returns, the PCs that are still operating automatically reconnect to the server.

GATEWAY OPERATIONS To the front-end processor, the VINES 3270 communications services make the Banyan Corporate Network Server look like a terminal cluster controller. The CNS can link



The Banyan Corporate Network Server, a floor-standing pedestal computer, can hold up to 24MB of memory to feed its 20-MHz 80386 processor. Cards inserted into seven AT-compatible expansion slots handle connections for communications ports and up to four separate networks.

to the front-end processor with a maximum of three SNA communications lines, and the gateway can distribute 32 mainframe sessions among the network work-

stations for each communications line. While the CNS emulates a 3274, it cannot attach real 3278/9 terminals to the system the way the Harris 9300 can.

The VINES 3270 PC terminal emulation software allows each PC to conduct four simultaneous sessions. One session is usually LU3 (the logical unit classification used and the way that the LU is identified by the controller it's connected to; see the glossary), which lets the mainframe control a printer attached to the PC. The terminal emulation software can emulate a 3279 Model 2b with extended attributes and color graphics.

PCs on the Banyan network need a lot of RAM. After our 512K-RAM XT loaded DOS, the Banyan VINES networking software, and the 3270 terminal emulator configured for four LUs, DOS's CHKDSK showed about 238K of RAM free. Banyan's terminal emulation software occupies nearly 100K of RAM; however, if you load it last, you can issue the command REL3270 to free this memory when you no longer require terminal emulation.

VINES 3.0 performed very well in the LAN Gateway performance tests. It didn't beat Novell's NetWare running on the IBM Token-Ring Network adapter cards and a Wyse 10-MHz 80286-based server for the

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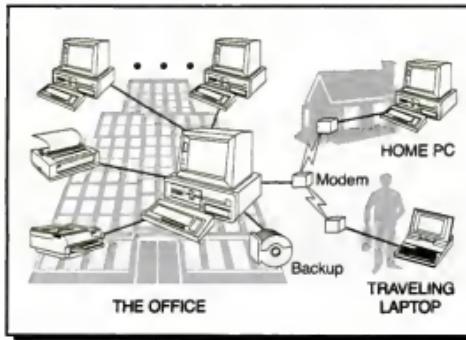
PC users say EZCOPY is their preferred way to transfer files between hard disks, 5 1/4" and 3 1/2" diskettes. EasyLAN Version 4.0's EZCOPY File Transfer command is 30% faster and automatically moves data files between PCs in the office without interrupting the PCs or users. File operations are done in the background.

New Standard Features

New Menu Interface—On-screen menu interface lets new users quickly use the network

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PBX Support—EasyLAN lets a telephone and PC use the same twisted pair wire, on any PBX with data features.



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Nothing new to learn, print at any time to any serial or parallel printer. EasyLAN Version 4.0's disk spooling support lets everyone in the office automatically share the new laser printer and existing printers. Printer sharing and print spooling operate transparently with existing applications.

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■ LAN GATEWAYS

LAN tests, but it came close.

Organizations with a strong PC orientation will be comfortable with Banyan's VINES 3.0 running on the Banyan Corporate Network Server. The software is powerful and easy to use. The hardware is a



veritable Mack truck, but its AT card slots and built-in I/O ports make it familiar and comfortable equipment. Best of all, its extensive options give it the flexibility many organizations need in an expanding communications environment.

HARRIS CORP.

Harris 9300 Network Communications System

The Harris 9300 Network Communications System is not your typical LAN. Rather, the system is designed for organizations with a heavy investment in IBM mainframes that also need PC network services.

The standard 9300 (the Tower model) comes in a floor-mounted cabinet about 26 by 12 by 24 inches (HWD). You can pack the cabinet with as many as three hard-disk drives holding up to 117MB each, a tape backup unit, up to 2MB of RAM, a four-port RS-232C serial board for modems or printers, and other devices such as adapters for multibus expansion cards. (A smaller and less-expensive Desktop 9300 model has the same basic functionality but supports fewer peripherals.)

HEART OF THE SYSTEM The heart of the Harris 9300 system is its LAN server, a special computer that acts as a print server, file server, and communications server. This LAN server, which can replace an IBM 3275 terminal cluster controller, connects up to 16 PCs running MS-DOS and 16 standard 3270 terminals to the mainframe.

The version of the 9300 that we tested was built around an Intel 80186 processor, the highly integrated version of the 8086. Using an 8-bit 80186 processor in such a

system is like having a pony pull a heavy cart: the performance of the LAN server was directly affected by the processor speed, as well as by its underlying Xenix structure.

A version of the server based on the 80386 processor, however, should be available about the time this article is published. Though the 9300 did better than ex-

pected in our gateway performance tests because of the gateway card's dedicated processor, this added processing power will be welcome.

Because the 9300 runs Microsoft's multitasking Xenix operating system, you can run many processes simultaneously. The 9300 can handle up to four Remote Job Entry (RJE) communications lines, and both RJE and 3270 operations can share the same line. In theory, each PC can connect to two mainframes at once and have sessions running on both simultaneously. The Harris system supports IBM's RJE batch-processing operations



FACT FILE

Harris 9300 Network Communications System
Harris Corp.
Data Communications Division
P.O. Box 809022
Dallas, TX 75380-9022
(214) 386-2000

List Price: Desktop 9300, \$4,850; Tower 9300, \$9,725; Harris-PC Network Interface Card, \$275; SNA Gateway, \$1,300; four-Port RS-232 card (required for Gateway), \$350. LAN software: for Desktop 9300, \$1,000; for Tower 9300, \$1,800.

In Short: An integrated 3270 gateway and LAN server that does a complete job of emulating an IBM 3274 cluster controller. Software offers centralized management of client stations and many communications options, including 3270 RJE operations and a DIS-QSS (see glossary) gateway.

CIRCLE 66 ON READER SERVICE CARD

and its electronic-mail system.

Since the 9300 is designed to run Microsoft's Xenix operating system, it isn't surprising that the 5½-inch floppy disk drive in the unit reads the 720K Altos format, a standard in the Xenix marketplace. A special disk utility allows you to exchange MS-DOS-formatted disks with the server.

The 9300's features for local area network service seem almost an aside; they're simply another task that runs under Xenix. The LAN software, which allows DOS ap-

plications to share files and printers, follows MS-DOS 3.1 file- and record-locking standards. The system also offers a NetBIOS module for programs using the NetBIOS services to communicate across the LAN. While the Harris 9300 software requires a dedicated server, any PC attached to the network can act as a file or print server.

GATEWAY OPERATIONS The Harris 9300's 3270 terminal emulation software, which allows PCs on the network to act as IBM 3278 terminals, isn't fancy—but it does have all the basic functions, including support for 80-column screens with panning. Harris supplies the keyboard mapping scheme established by DCA's IRMA products. The emulator software occupies about 97K of RAM when it runs a single session with one LU. And the gateway hardware consists of an SDLC interface card with a separate 80186 processor to speed gateway operations.

IBM PCs connect to the network via the Harris PC Network Interface Cards. These cards require a dedicated cable connection of twisted-pair telephone wire or shielded twisted-pair wire for longer runs between each workstation and the server. Wire runs can be up to 2,000 feet long if you install cable meeting the IBM Type I specifications.

■ LAN GATEWAYS



Performance Tests: LAN Gateways

The LAN gateway performance tests show that the throughput of both small and large data blocks depends on several factors, including the ability of the network adapter cards to handle small data blocks and the efficiency of the 3270/SNA gateway adapter card. The design of the gateway software is particularly important: software differences account for the Banyan CNS system's greater success at moving small blocks of data and the Harris 9300's relative efficiency in transporting large blocks. Of course, neither did as well at either task as did IBM's standalone gateway.

Both gateway products under review came very close to saturating the 19.2-kilobit-per-second line to the front-end processor (FEP)—a testimony to their effective rates of throughput. The 80386-based Banyan system, which had greater processing power than the 80186-based Harris, performed well as a gateway and a server. The 9300, however, which hardly set access speed records when performing as a server, did better as a LAN gateway.

The LAN gateway performance tests use a mainframe software package called IC3270, developed by Innovative Communications, to automatically load and exercise the test-bed's workstations and gateway, allowing a choice from among a wide variety of tasks and data-loading levels. With the exception of the single-user response test, the tests ran without the variations caused by human input.

All tests, except for the file transfer test, stressed the gateway board and software, LAN interface cards and software, and the 3278 terminal simulation software in the PCs acting as terminals. The different block sizes used in these tests caused varying degrees of efficiency in both the LAN packets (or tokens) and the SNA/SDLC response units. The loading tests stretched the resources of the PCs operating as terminals to their limits, and the results equate to the activities of dozens of machines in typical operations.*

Each of the six tests falls under one of two categories: throughput or performance time. The throughput tests (Mainframe-to-Terminal Small- and Large-Block Throughput and Terminal-to-Mainframe Screen-Buffer Dump) measure in bits per second how quickly the gateway can send data back and forth between mainframes and PCs emulating terminals; the more bits the gateway can transmit, the better (hence the larger the 3-D bar on the chart, the better). The performance time tests (User Response—system loaded and unloaded—and File Transfer) measure how long it takes the system to perform a given task; hence the shorter times are preferable (corresponding to shorter bars on the accompanying chart).

THE TEST-BED. The LAN gateway tests were run on LANs connected over 19.2-kilobit-per-second

RS-232C lines using the SNA/SDLC protocols through a 3725 front-end processor to a leased IBM 3084 computer. The mainframe, which was not loaded by any other functions, was configured as two 3081s running the IBM extended architecture (IBM XA) and run under IBM's Virtual Machine High Performance Option (VM/HPO) and MVS CICS, Version 1.7. The "terminals" connected to the LAN gateways were IBM PC-XTs. (Because we needed access to a dedicated mainframe in order to test the gateway performance of these LANs, we were unable to perform the tests on-site at PC LAN Labs. As a result, we were forced to substitute IBM PC-XTs for the 6-MHz PC ATs we normally use as network workstations. ATs will be the norm for these tests in the future.)

The Banyan system consisted of the Banyan Corporate Network Server and VINES 3.0 networking software, with IBM Token-Ring Network adapter cards for the workstations. The Harris system included the company's 9300 server and Xenix operating system, with Harris PC Network Interface cards in the workstations.

For purposes of comparison, we tested the performance of the Harris and Banyan systems against that of the Digital Computer Associates (DCA) IRIMALAN and the IBM 3270 LAN Gateway. Both of the latter products, which were configured using a separate AT as a gateway machine, will be reviewed in depth along with other competitors in the next issue of PC Magazine.

In the Mainframe-to-Terminal Small-Block Throughput and Large-Block Throughput tests, the test software measures the total amount of data sent from the mainframe to six active IBM PC-XT terminals in a 5-minute period, deriving an

average throughput figure in bits per second. In the small-block test, the data was in 512- and 1,024-byte blocks; in the large-block test, the data was in 6,144- and 8,192-byte blocks. Results for the Small-Block Throughput test are important to those who want their PCs to emulate a terminal so that they can enter data into the mainframe.

The Terminal-to-Mainframe Screen-Buffer

Dump test forces the terminals to send data to the mainframe in 1,920-byte blocks (the size of a screen buffer) as quickly as they can. The software measures the total amount of data sent from six active IBM PC-XT terminals in a 5-minute period and derives an average throughput figure. Performance on this test is important to users who want to page through screens of data contained in their mainframe, such as records in its database management system.

The User Response test is run from a seventh computer (an XT in this case) while the gateway is loaded by six terminals receiving small end large data blocks. This is the only test that requires human intervention. It is designed to emulate how a person actually works with the system, including use of the keyboard. For the test, the operator uses the terminal's keyboard to scroll a large data stream through the display buffer. We use a stopwatch to time these results, and the number given is the average of ten trials. Results of the same tests run in an unloaded system are supplied for comparison.

The File Transfer test involves transferring a 50K file of ASCII data from a PC-XT workstation to the mainframe under conditions of no load and timing the procedure. Unless indicated, the IBM INDSFILE editor is used on the mainframe and to accept the file.

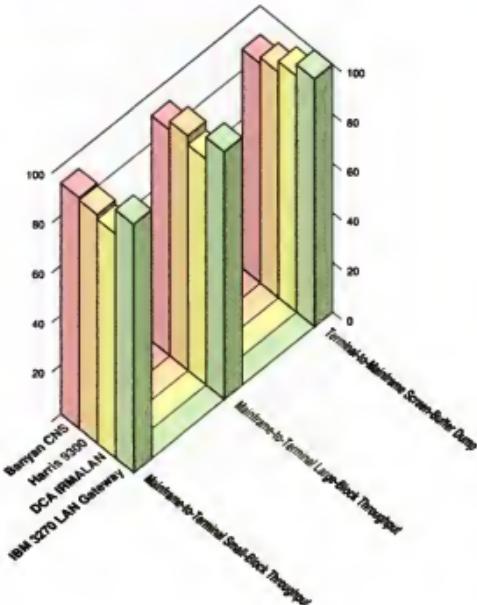
* To obtain a more detailed description of the procedures and parameters used during the PC Magazine LAN gateway tests, write to Innovative Communications Inc., P.O. Box 3590, Framingham, MA 01701, or phone the company at (508) 875-4821 or (508) 855-4364.

Throughput Tests

(Longer bars represent better performance)

Relative Performance

(IBM 3270 LAN Gateway = 100)

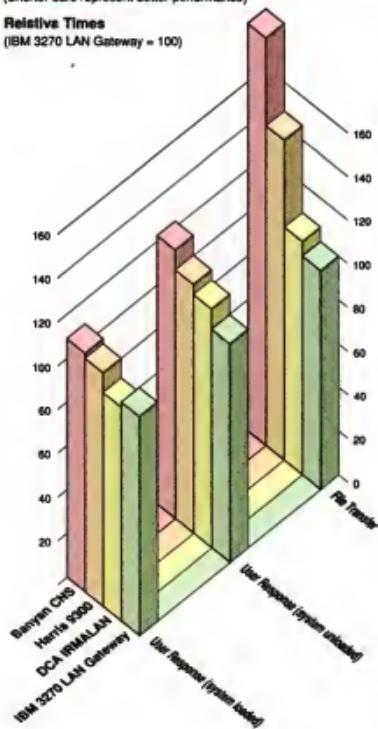


Performance Time Tests

(Shorter bars represent better performance)

Relative Times

(IBM 3270 LAN Gateway = 100)



Both gateway products under review came very close to saturating the 19.2-kilobit-per-second line to the FEP, a testimony to their effective rates of throughput.

Throughput Tests

(Results given in bits per second)

	Mainframe-to-Terminal Small-Block Throughput	Mainframe-to-Terminal Large-Block Throughput	Terminal-to-Mainframe Screen-Buffer Dump	User Response (system loaded)	User Response (system unloaded)	File Transfer
Banyan CNS	14,529	16,095	14,153	4.8	2.7	112
Harris 9300	14,375	16,720	14,553	4.7	2.5	88
DCA IRMALAN	14,093	16,084	15,248	4.3	2.4	64
IBM 3270 LAN Gateway	15,613	17,655	15,991	4.4	2.2	60

Results for the Mainframe-to-Terminal Small-Block Throughput test are important to users who want their PCs to emulate a terminal so that they can enter data into the mainframe.

Performance on this test is important to users who want to page through screens of data contained on their mainframe, such as records in its database management system.

■ LAN GATEWAYS



Benchmark Tests: LAN Gateways

The PC Labs benchmark test results showed that a network's performance is not necessarily related to the speed of the chip upon which it is based. On these LAN tests, Novell's Advanced NetWare 2.0a posted the best results overall even though it used an 80286-based server. But the Banyan Corporate Network Server (CNS) running VINES 3.0, a new version of VINES designed for the 80386, did well: the performance of VINES 3.0 showed a significant improvement over that of previous versions of VINES running on Banyan servers based on the Motorola 68000 family of processors. The Harris 9300 system's reliance on a 80186-based server explained its comparatively poor performance.

The Banyan system consisted of the Banyan Corporate Network Server running the VINES 3.0 operating system, with IBM Token-Ring Network adapter cards for the workstations. The Harris system consisted of the company's 9300 server and Xenix operating system, with Harris PC Network interface cards in the workstations.

For purposes of comparison, the Harris and Banyan networks were tested against two popular LAN systems. The IBM system consisted of an IBM PS/2 Model 80 running IBM's PC LAN software. The Novell system consisted of a Wyse 10-MHz 80286 machine running Novell's Advanced NetWare, Version 2.0a. In both cases, the workstations were connected to the network via IBM Token-Ring Network adapter cards.

All of these benchmark tests were run using IBM PC-XTs as workstations. (Because we needed access to a dedicated mainframe in order to test the gateway performance of these LANs, we were unable to perform the tests on-site at PC LAN Labs. As a result, we were forced to substitute IBM PC-XTs for the 8-MHz IBM PC ATs that we normally use as network workstations; only the "zero-stations" test was performed on an 8-MHz PC AT. For this reason, the only test results that can be compared directly to previously published results for other networks are those for the zero-stations test.)

Performance Times

(Times given in seconds)

Network Speed Under Load

Server	Interface card	Software	Zero stations	Two stations	Four stations	Six stations
Harris 9300	Harris PC Network	HarrisNet	799	845	899	1,009
IBM PS/2 Model 80	IBM Token-Ring Network	PC LAN	401	419	471	617
Banyan CNS	IBM Token-Ring Network	VINES 3.0	445	479	545	632
Wyse 10-MHz 80286	IBM Token-Ring Network	Advanced NetWare 2.0a	330	339	358	485

Hard Disk Access Load

Server	Interface card	Software	Zero stations	Two stations	Four stations	Six stations
Harris 9300	Harris PC Network	HarrisNet	383	482	569	775
IBM PS/2 Model 80	IBM Token-Ring Network	PC LAN	190	190	224	252
Banyan CNS	IBM Token-Ring Network	VINES 3.0	169	296	482	747
Wyse 10-MHz 80286	IBM Token-Ring Network	Advanced NetWare 2.0a	165	174	182	198

Database Load

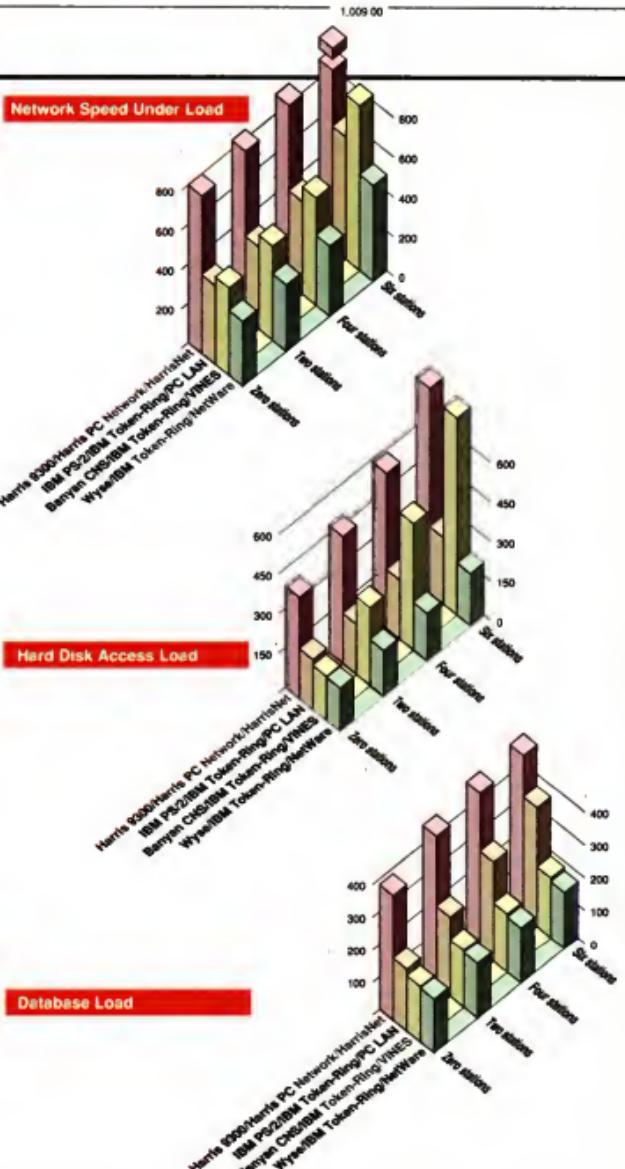
Server	Interface card	Software	Zero stations	Two stations	Four stations	Six stations
Harris 9300	Harris PC Network	HarrisNet	383	456	482	489
IBM PS/2 Model 80	IBM Token-Ring Network	PC LAN	190	243	305	363
Banyan CNS	IBM Token-Ring Network	VINES 3.0	169	175	179	183
Wyse 10-MHz 80286	IBM Token-Ring Network	Advanced NetWare 2.0a	165	166	170	172

The Network Speed Under Load and the **Hard Disk Access Load** benchmark tests measure the time needed to perform a standardized task on the network. While the actual work loads used for these two tests (described below) are different, we used the same procedure for both. To obtain the elapsed time shown here, we ran a benchmark program performing a sequential create, a sequential read, a sequential write, a random read, and a random write of a large file. The record sizes used in these activities systematically rotate between 16K, 4K, and 512 bytes. The numbers shown in the three-dimensional chart are the total times necessary for all of these operations. We ran the test on all our machines to load the network while timing just one of them. We then reduced the number of workstations two at a time to show the effect of loading on the network.

The **Network Speed Under Load** test puts a heavy load on the network interface (cards, media, and so forth) while placing a minimal load on the hard disk by having each station continuously read and write its own 1-byte data file, changing the data each time. For systems with disk caching, the load on the hard disk is even smaller, since cached systems typically perform a disk write but do not require a physical disk read.

The **Hard Disk Access Load** test heavily loads the hard disk and disk-caching system. To do this, each station randomly accesses its own 100K data file using 1K records. Data written to the file is changed each time. The random reads typically access data outside the cache, which forces a disk read, as does any write.

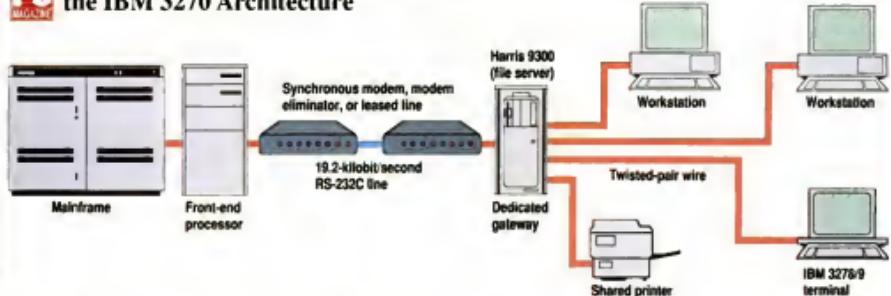
The **Database Load** test exercises the system's record-locking support and the way it handles a number of random simultaneous accesses to a common file. This test times how fast each loading station accesses a common database consisting of an index and a data file. Half the accesses are simple searches of the index file and an accompanying access to a record in the data file. One-quarter of the accesses perform the same operation but also lock the data record and update its contents. The remaining accesses update the index file and a data record. The index file is locked during every update, and the DOS 3.1 RLOCK statement prevents simultaneous index file updates.



■ LAN GATEWAYS



The Harris 9300 as a Gateway into the IBM 3270 Architecture



The Harris 9300 can act as a LAN server for up to 16 PCs and connect up to 16 standard 3270-family terminals to a mainframe, replacing the typical IBM 3275 terminal cluster controller. The 9300 provides remote job entry (RJE) operations and e-mail; its

hardware requires a dedicated cable connection between each workstation and the server. Twisted-pair telephone wire can be used for short runs.

On the one hand, Harris's use of dedicated cables gives you less flexibility for moving stations than a point-to-point scheme in which each station is connected to the next. On the other hand, one bad cable or connector won't crash the system. This wiring architecture also makes for simpler card designs and eliminates the need for media-sharing schemes like CSMA or token-passing.

But while theoretically a lack of contention for access to the connection should have improved network performance, the benchmark-test results didn't bear that out. Apparently, the system does suffer from high disk drive and server CPU contention.

NETWORK ADMINISTRATION Central to the operation of all of Harris's networking software is a feature called Keyview. Keyview displays a line of blocks on the bottom of the screen that represent special function keys. As you operate a Harris program or utility, the Keyview blocks allow you to choose from various network resources, including printers and communications ports.

The most important utility for the network administrator is the configuration table, which contains information about all the devices connected to the network. Be-



The heart of the Harris 9300 Network Communications System is its LAN server, a special 80186-based computer that acts as a print, file, and communications server; it is shown with an RS-232 terminal and (inset) a 3270 mainframe suite. The 9300 can handle up to four Remote Job Entry (RJE) communications lines, and both RJE and 3270 operations can share the same line.

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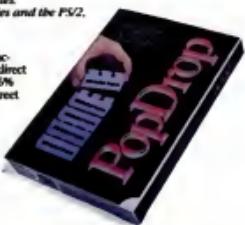
PopDrop will let you safely "de-activate" and "re-activate" programs to avoid conflicts with the program you're using. The *PopView* command displays exactly what's loaded, how many layers exist, how much memory is being consumed and how much is free. And only PopDrop will support expanded memory (EMS) so you can run the "new-generation" RAM-resident programs like *Sidekick Plus*, *WordPerfect Library* and *VCache*. PopDrop also allows easy removal or "de-activation" of popular network software.

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■ LAN GATEWAYS



The overall strategy behind the Harris 9300's design makes it a perfect fit for organizations that heavily use IBM 3270 computer systems and need to blend in PCs gradually.

cause the workstations in this system boot from the server, the network administrator can make all necessary changes from the configuration table.

THE COMPLETE PICTURE Also important is the Network Manager Screen, which paints a picture of the network developed from the configuration table. The on-screen diagram shows active users, active mainframe sessions, and detailed data on each PC's network usage. The loop-back test—initiated throughout the management software—is another tool for the administrator. This test allows you to diagnose network problems by exchanging data between PCs and the server, between networked servers, and between the server and the mainframe front-end processor until the problem is isolated.

The strategy behind the 9300's design makes it a perfect fit for organizations that heavily use IBM 3270 computer systems and need to blend in PCs gradually. A faster disk drive and more powerful processor, however, would help the 9300 systems. We suggest, therefore, that you wait to evaluate the promised 80386 version of the Harris server.

Frank J. Derfler, Jr., is workgroup systems editor of PC Magazine.

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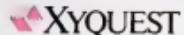
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WORDPERFECT



ON THE MOVE

The admen who coined the expression *word processing* 15 years ago as a play on the term *data processing* had the right idea: computers should be as versatile with words as they are with numbers. Despite their optimism, word processing has never lived up to its promise: writers have yet to reap the same benefits that accountants and database managers have long enjoyed. First, programmers have had to evolve a way of managing text on-screen that is fast and fluid—yet as familiar to the eye as a type-written page. Then, a plague of incompatible printer protocols had to be brought under control. Most recently, a guerrilla war of bells and whistles that brought few enhancements to basic word processing has left the word, as the new unit of processing, largely forgotten.

Already one of the most popular word processors, WordPerfect is leading a charge into the desktop publishing arena. Will the competition follow?

■ WORDPERFECT 5.0

Fortunately, there's hope: it begins with WordPerfect Corp.'s newest revamp of *WordPerfect*. For a street price of about \$40 more than *Microsoft Word* and other top sellers, Version 5.0 (list price, \$495) offers among its new features improvements on past efforts (printer support included) plus all the desktop publishing features that one could hope for from a character-based word processor. But while bit-mapped graphics and font management rank high in the program's latest, *WordPerfect* never forgets your basic goal—that of arranging well-chosen words on paper to get an idea across.

As of Version 5.0 and its subsequent enhancement, which fixed some initial bugs, *WordPerfect* is now the most powerful, configurable, and multitalented word processing program ever to appear on any class of computer system. And there are no gadgets to avoid: we've been offered instead a powerhouse program that

- imports graphics and handles fonts better than any other program of its type;
- can generate forward and backward references to text or figures on other pages in your document, or even in other documents;
- will highlight changed and deleted sections of your document by comparing it with an old version; and
- takes advantage of laser printer technology, yet performs on-the-fly "best fit"



WordPerfect's graphics editing screen allows you to move, rotate, and scale an image within a containing frame of any dimensions. The sensitivity of the cursor keys is adjustable via the *Ins* key.

emulation of any printer by any other printer—for example, you can now get working drafts of a PostScript document out of an FX-80.

RICH GRAPHICS SUPPORT *WordPerfect*'s graphics support is remarkably rich for a first time at bat. It's easy to learn, and you don't even need a graphics card unless you want to edit the images. You can't modify the content of graphic images because *WordPerfect* doesn't have the drawing, shading, or fat-bit editing features found in programs like Z-Soft's *PC Paintbrush*. But you can frame graphic images within their enclosing boxes and manipulate them with Move, Scale, and Rotate controls, as well as Invert them (reverse each bit). In addition, you have full control over their final dimensions and placement on the page.

Graphic images are always immediately imported into your document, making 5.0 independent of secondary files beyond this point. It's no slowpoke either; one 59K .PCX file, for instance, took 8.1 seconds to import. The name of the original

graphic file appears in the Reveal Codes screen for documentation only. (Unfortunately, 5.0 doesn't sense when the same graphic is specified twice; it will import a redundant copy rather than refer to the existing copy of the image.)

Images can be placed on the page or in headers, footers, footnotes, and end notes. They can even overlap one another. You can have captions inside or outside the box, and the surrounding text can wrap around or not, as you choose.

Version 5.0 converts graphics in three ways: importing during text editing, importing off-line through the GRAPHCNV .EXE conversion program, or by using a screen grabber called GRAB.COM. One way or another, the following formats are supported: .CGM, .DHP, .DXF, .EPS, .HPGL, .IMG, .MSP, .PCX, .PIC, .PNTG, .PPIC, .TIFF, and the new .WPG (*WordPerfect Graphic*).

You can also specify border style, numbering method, caption (including position and style), and percentage of gray shading for any box. You can place the box at a fixed location on the page, let it float with a



FACT FILE

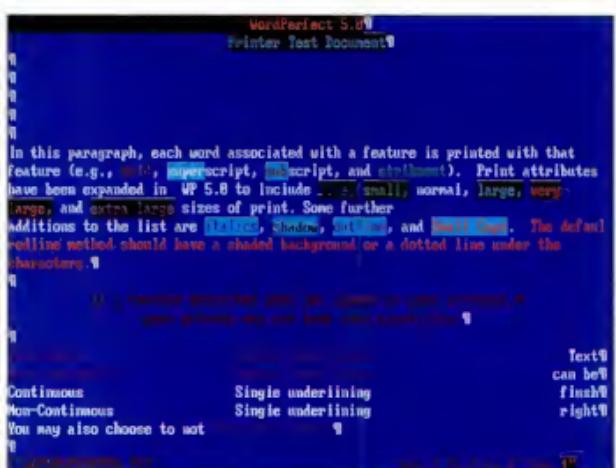


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(801) 225-5000

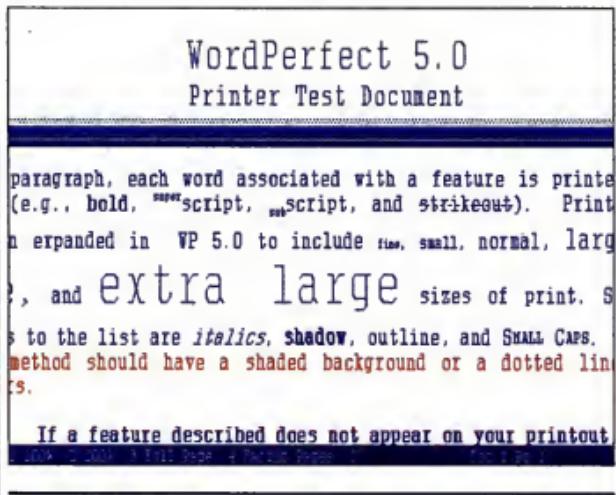
List Price: \$495; upgrade from 4.2, \$60.
Requires: 384K RAM (512K RAM and hard disk recommended), DOS 2.0 or later.
In Short: Outstanding graphics and font-control features of this new release, plus scores of incremental enhancements, will make you think twice about that desktop publishing program you thought you needed. Not copy protected.

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WORDPERFECT 5.0



As you edit, WordPerfect 5.0 displays highlighting attributes in whatever character mode your monitor supports. (In the example above, an EGA monitor uses an assortment of colors; on a monochrome, characters might be boldfaced or underlined.) If you switch to page preview (shown below at WordPerfect's 200 percent magnification), you'll see a rough approximation of the same attributes that will appear in the printed output, but you can't edit while in page preview.



paragraph, or attach it to an individual character; the last method, for instance, would be helpful for iconic key names in a computer manual.

During normal text editing, a placeholding rectangle appears on-screen identified by the box type and number, such as "FIG 1." Boxes come in four separately numbered types—figures, tables, text, and user defined—each of which offers varying options. Figures default to Arabic numbering; tables, to Roman numerals. Text boxes are good for quotes and sidebars; you can import an external *WordPerfect* document into them and edit the text afterward. You can generate a list of figures separate from a list of tables, and each list will show the box number and caption. You can even change the box type after creating it.

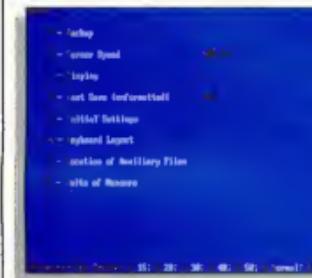
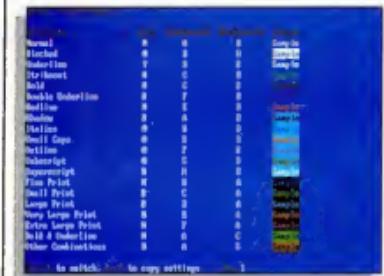
Optional box borders can use single- and double-line characters, or be dashed or dotted as well as thick or extra thick. You can specify inner margins that separate the box from the graphic, with outer margins distinguishing the box from the surrounding text—and the box number is incremented automatically.

Page preview (possibly the fastest one in word processing; other programs that have this feature include *Microsoft Word*, *WordStar*, *Lotus's Manuscript*, and *Sanna*) lets you zoom in to any part of a page at up to twice its actual size. It's interruptible, so if you're not interested in the view it's drawing, don't wait to say so. Both the graphics-editing and the page-preview screens let you adjust the scroll factor of the cursor keys simply by pressing Ins.

TRUE FONT MANAGEMENT Font control in 4.2 was anemic. You could define only eight fonts for each printer, and you had to change the pitch and margin settings manually each time you switched because all 4.2 knew about fonts was how to ask the printer to select one. In Version 5.0, font management is more flexible than that of most high-end desktop publishing programs.

First of all, a 5.0 purchase includes a copy of Bitstream's *Fontware*, a program for generating downloadable font files for HP laser and PostScript printers. *Fontware* comes with "outlines" for each typeface it

WordPerfect 5.0 at a Glance



Advance In addition to advancing the page by half-lines for super- and subscripting, you can now advance to an absolute location on the printed page if you have a laser printer.

Append You can add a marked block of text to a file on-disk.

Automatic reference You can generate references like "For more information on tube sock magnetizers, see page 31" automatically by naming the target location and referring to the name instead of to an absolute page number.

Block operations You can now move a block without first having to cut it.

Colors, fonts, and attributes Setup now lets you configure how different text attributes appear on the screen. You can fully customize the behavior of CGA, EGA, VGA, and Hercules cards. The Hercules RemFont feature is supported.

Columns Parallel columns now handle page breaks correctly.

Compose To select one of 1,702 characters, first press Ctrl-2, then two letters. For instance, A and E give Æ, end e and ' give é.

Cursor speed Version 5.0 includes Repeat Performance, a program that lets your cursor travel at up to a nimble 50 characters per second.

Document compare Redline codes and strikethrough text can be added to your document by keeping the old version as a reference and having Version 5.0 compare it with the new one.

Expanded memory Version 5.0 can use LIM 3.2 and 4.0 expanded memory for overflow files and program overlays and menus.

Extended search You can now search headers, footers, end notes, graphics box captions, and text boxes.

Force odd or even page You can force WordPerfect to skip a blank page, so that your output resumes on the next odd (or even) page.

Kerning You can close up pairs of letters whose shapes cause excessive white space, like the "By" in "Bylines," and the printer utility lets you modify the kerning table for any font.

Key assignments Version 5.0 is 85 percent identical with Version 4.2. Graphic functions are accessed via Alt-F9, and setup functions, which no longer require "je" on the command line, via Shift-F1. Outline functions have been moved to Shift-F5, and format functions have been consolidated on the F8 key.

Keyboard layout You can now reassign any function or group of functions to any function key.

Language codes You can indicate that separate parts of your document are written in up to 14 different languages. When using the spelling checker or thesaurus in different parts of the document, WordPerfect will automatically switch to the appropriate dictionary.

Line height The amount of space reserved for each line can be fixed or "auto"; auto means that Version 5.0 will choose a height appropriate for the mix of fonts found on that line.

Line spacing The restriction in Version 4.2 that line spacing must be six or eight lines per inch has been lifted. Line spacing is given as any multiple of line height.

List files You can move a file to a different directory in addition to renaming it, and you can access the file directory while importing a graphic image.

Master documents Chapters of a book can be kept in separate files, each of which can contain footnotes, index entries, and references to pages in other chapters.

Measurement units Measurements can be specified in inches, centimeters, points, and (using the undocumented "w" option) $\frac{1}{100}$ -inch units.

Menus Menus can now be selected by letter as well as number, except for the spelling and thesaurus menus. This single enhancement speeds up operations considerably since you can now keep your hands on the home row of the keyboard.

Page preview Page preview lets you see a page exactly as it will look when it comes out of your printer. You can see the page in its actual size, twice actual size, or see one or two pages in their entirety.

Paper size and type A list of available sizes and types of paper is kept for each printer you use. When selecting a form, you can change the assumed physical page dimensions, orientation, and optional bin number.

Print color You can select colors from a menu instead of inserting control codes that only you and your printer know.

Print quality You can independently set the quality of text and graphics to Do Not Print, Draft, Medium, or High. On laser printers, Draft is 75 dots per inch, Medium is 150, and High is 300.

Printer help Each driver distributed with Version 5.0 contains a page of hints to help you understand what it can and can't do. This help page can be displayed from within WordPerfect when you select a printer, or from the printer utility.

Printer initialization You can easily download soft fonts on demand. WordPerfect 5.0 knows which fonts your document needs and whether it has downloaded them yet.

Redline and strikeover These are now completely automatic if you save an old edition of your document.

Reference manual A Special Features section now integrated into the main body of the text makes the reference manual much easier to navigate than before.

Retrieve WordPerfect now warns you if you're loading a document into the middle of an existing one. (This often happens to new users when they forget to exit from the file they just saved.)

Reveal codes Even when codes are revealed, full text editing is permitted. To hide the codes, press Alt-F3 again.

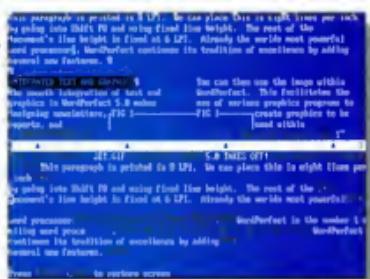
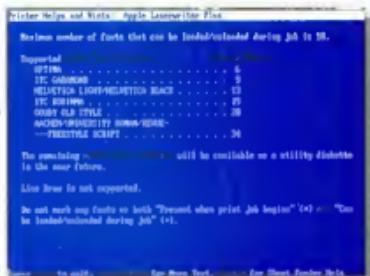
Screen capture A neat TSR called GRAB.COM captures graphic screens in WordPerfect's own format.

Search You can now search for many more formatting codes than before, including the ending code of a code pair.

Setup defaults Setup can be entered at any time, and you don't have to type "%s" on the command line.

Word and letter spacing WordPerfect lets you fine-tune how it spaces words and letters.

Word search New options let you restrict your search to documents within a date range, the first page of each document, just the document summaries, or any combination of these.



WORDPERFECT 5.0

File: C:\WPS\WPLASPLU.PFS

Printer: Apple Laserwriter Plus
Font: Times Roman
Size and Spacing Information

Font Cell Height (Points: 1 Point = 1/72 inch) 18.7
Default Leading (Points) 1.3
Width Scaling Factor 1
Optimal Character Width (% of Font Width) 188
Optimal Space Width (% of Font Width) 75
Character Cell Adjust (+128ths) 8
Baseline Bias Factor (Points) 8
Amount to Slant Font (Degrees) 8
Proportional Spacing Table: Times Roman

PS Table Information (change in PS Table)
Average PS Table Width (PS Table Units): 589 PostScript Units
Average Scaled Width (PS Table Units): 589 PostScript Units

Enter Values
Press Enter to Edit

PTR.EXE, WordPerfect's new printer utility, is fully menu-driven and offers more configuration options—such as character and space widths—than does any other word processor. Its support of PCL and PostScript printers is nothing short of revolutionary.

generates—mathematical blueprints that define precisely the lines and curves in each character. It even knows how to deviate from its blueprint in subtle ways, so your font will look smooth in different sizes. If you like the idea of having an assortment of fonts to work with, you'll be generating scores of them with this fault-tolerant compiler.

For PostScript printers, *Fontware* builds one file for each weight of each typeface. For HP PCL printers, it builds a separate file for each size of each weight, which can add up quickly. And *Fontware* builds each font file bit by bit—it takes only about 5 minutes, for instance, to compile a 10-point Times Roman typeface on an 8-MHz machine.

Out of the fonts already included with *WordPerfect*—Bitstream's Dutch (Times Roman), Swiss (Helvetica), and Charter in roman, italic, bold, and bold italic—you select a *base font* that can be changed anywhere in the document. Here you can also specify relative sizes like superscript, subscript, fine, small, large, very large, and

extra large, or you can indicate stylistic variations like bold, underline, double-underline, italic, outline, shadow, and small caps. These attributes remain in effect even if you change your base font or if it's converted when you move your document to another workstation and printer.

Automatic font changing, included among your font-management options, is more useful than it may first appear. Suppose you select 10-point Times Roman as the base font for an annual report that will be printed on an HP LaserJet II using the Hewlett-Packard AC soft font set. If you mark your document title "extra large," your section headers "very large," and your headers and footers "large," 5.0 will assign 24-point Times Roman bold to the first, 18-point bold to the second, and 12-point to the third.

So far you haven't really gained much over setting fonts explicitly. But if you now decide that you want a version in bigger type, all you have to do is change the base font at the top of the document to 12-point Helvetica. *WordPerfect* 5.0 will

automatically change your title to 30-point Helvetica bold, your section headers to 24-point bold, and your headers and footers to 14-point. Just try doing this with *Page-Maker* or *Ventura Publisher*! If you don't like any of *WordPerfect* 5.0's automatic font selections, you can use their printer utility to change them.

The printer drivers use simple tables to determine, for example, which automatic font change turns on an attribute like italic. And they know which characters are available in which font. If necessary, the drivers can commandeer a character from a font other than the base font and can assemble digraphs and diacriticals by overprinting their separate components.

IMPROVED PAGE LAYOUT At long last *WordPerfect* has caught up with *Microsoft Word* and other programs that define page layout in terms of units of measurement like inches or picas rather than characters and lines.

In 4.2, line margins were a function of two variables: character pitch and beginning and ending columns. Using 10-pitch Courier on an 8.5- by 11-inch form, you had to specify a pitch of 10 and margins of 10 and 74 to get 1-inch margins. With a 12-pitch daisy wheel, you had to change pitch to 12 and margins to 12 and 89.

Similarly, top and bottom margins were specified as beginning and ending lines that were functions of the lines-per-inch setting. You could pick only 6 or 8 lines per inch, but you could do things like double-space at 8 lpi to get 4 lpi—which then wrecked your bottom margin. Advanced users wrote keyboard macros to handle some of this, but it was embarrassing to wrestle with 4.2's typewriter mentality when showing off the program to friends and associates.

Proportional spacing, at least, worked well in the simplest case. For instance, if you now switched from a fixed-pitch to a proportional daisy wheel and changed your pitch to "12**" (an average character pitch of 12), you got a varying number of characters across the page because *WordPerfect* was smart enough to note the percentage of fat characters versus thin on each line. This justification worked beautifully, even in multicolumn format. And since *WordPerfect* had the best printer util-



WordPerfect 5.0: Not Yet Desktop Publishing

Although WordPerfect Corp. has taken great pains to resist the temptation to claim that WordPerfect, Version 5.0, is a true desktop publishing program, it's amazing how easily 5.0 can indeed produce output that competes well with the big boys. It imports graphics files in a great variety of formats and deftly mixes any number of fonts on a justified line. Vertical and horizontal lines can be placed anywhere on the page.

Below is the result of using WordPerfect 5.0 (driving a PostScript Printer) to reproduce the front page of *Bylines*, a "newsletter" that PC Magazine uses to test desktop publishing programs. The U.S. map logo is included in the sampler set of business graphics that comes free with 5.0. Note that too much space surrounds the "Y" in *Bylines*; the kerning tables that accompany 5.0 were not available at review time. (The Pagemaker version is to the right.)



Bylines

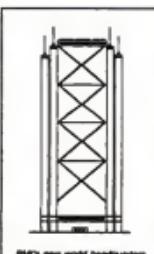
Ground-Breaking for New Headquarters Announced

It was all pomp and扇fare at the groundbreaking ceremonies for BMI's new corporate headquarters, held last Wednesday at the site on which the 27-story building will rise.

In attendance was BMI's entire Board of Directors, including Chairman Stephen W. Olson, as well as a contingent of local dignitaries headed by the Mayor of Minneapolis and his wife. A cheering crowd of 1000 looked on, and all BMI employees were given the day off so that they could attend.

"This is an important day in the history of our company," Olson said after he turned over a shovelful of dirt on the site with a gold-plated spade. "Our spectacular growth has been making headlines for years. Now we will have a corporate home that represents the status we have achieved in the management consulting industry."

After presenting Olson with a key to the city of Minneapolis, the Mayor commented, "As the leader of this great city, I am especially excited for me that to see another beautiful skyscraper thrust upward to signify to the world that Minneapolis is an dynamic and vibrant as ever."



Festive music was provided during the ceremony by the Edina High School Marching Band under the direction of Michael Lindstrom. Local circus performers also entertained, and a picnic lunch was provided for company employees. Blue skies and a warm breeze kept the party alive throughout the afternoon.

One BMI Plaza seems destined to become as famous as BMI itself, because the new building will be revolutionary, to say the least. The architect, Donald Wedrick of R.G. Nyström Associates of Chicago, echoes the Pompeiian Center in Paris and the Gherkin in London as one of London. Most of the building's pipes, doors, and elevators will be installed on the outside of the structure, allowing large open spaces inside.

A seven story atrium with cascading waterfalls and a lake will take advantage of the building's plan to its maximum, Chairman Olson said at Wednesday's ceremony. "We want our employees to work in a beautiful and comfortable environment."

Building services will include three cafeterias, a health club with a rock climbing tower available to all employees, and an in-house travel agency. One BMI Plaza will also be what is cer-

PageMaker version



Bylines

Ground-Breaking for New Headquarters Announced

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Inset photo: Page 21

A Message from Our President

This is an exciting day in the history of our company. I hope all of you enjoyed the grand opening of our new headquarters. When the building is finished, it will be something to behold.

But the business of business continues. And I would like to thank all of you who have mentioned us or my several employees in recent months; the state of BMI in South Africa.

An agency of ours here, BMI has opened a South African office in Cape Town in 1979. Two years ago, the situation in South Africa has deteriorated to such a state that many corporations have withdrawn from the country. But BMI is being forced to evaluate what we can move should be.

Let me emphasize that BMI does no business in the government of South Africa. All of our sales are to private enterprises.

Inset photo: Page 21

Where WordPerfect falls short in comparison with desktop publishing programs is its inability to handle columns of text—such as you would find in a newsletter—that jump to another page. DTP programs let you create a "frame" that you can lay out over several pages. Text poured into this frame is flowed automatically to the next place where the frame continues and moves automatically between pages to compensate for corrections. In contrast, WordPerfect lets you run text from the end of a column (as in the "Ground-Breaking" story) onto the very next column on page 2 (not shown) without excessive maneuvering, but that's all. While you can achieve the effect of story-jumping manually by pouring parts of your article into separate columns on different pages, you will also have to compensate for any modifications manually.

Although *Bylines* took only minutes to set up in 5.0, it wasn't fun. WordPerfect doesn't have the right kind of interface for this job; no character-based word processor does. Free-form design and layout work demands a graphical what-you-see-is-exactly-what-you-get screen, not just a slow page-preview function.

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WordPerfect version



ALPS ALQ224e

ALPS ALQ324e

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In PC printers, as in life, you can't always get what you want.

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SHALL RECEIVE.

There's even a choice of sizes. The compact ALQ224e is ideal for standard paper sizes and tight spots, while the wide-carriage ALQ324e can handle up to 16-inch-wide spreadsheets.

What's more, both printers come with a free ALPSmate software program, which gives you full control of your ALQe from your PC.

So ask your local ALPS dealer for a free ALQe demonstration. And if, for some reason, you find they're not exactly the type of printer you're looking for, call us at 800-828-ALPS.

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CIRCLE 242 ON READER SERVICE CARD



Performance Tests: Word Processors

Upgrading from WordPerfect 4.2 to 5.0 is simple and painless considering the differences between the two versions: just load the software into a new directory and go.

If you need to work on a document created by 4.2, it will be converted when you load it into the new 5.0 format. WordPerfect 5.0 documents can be stored in 5.0 format, 4.2 format, generic word processor format (with carriage returns at the ends of paragraphs), or ASCII format (with carriage returns where the line wraps).

It wouldn't hurt to wait a few months until WordPerfect Corp. works out any remaining kinks in 5.0, but there's no good reason to stay with 4.2 indefinitely unless you use so many RAM-resident programs that 5.0 won't fit in your remaining RAM. The \$60 upgrade fee is remarkably low compared with the hundreds of dollars charged by some companies.

The following performance test of the two versions against Microsoft Word 4.0 shows that WordPerfect 5.0's performance on PC Magazine's word processing tests (see accompanying descriptive captions) not only compares well with 4.2's but has actually improved

in some areas. The only disappointment appears in the time it takes to print to disk, but since printing is a background process anyway, most users may never notice the difference. Timings are in seconds. Not shown is the dramatic improvement in cursor speed resulting from WordPerfect's Repeat Performance utility.

Although 5.0 is as fast as 4.2, you'll need at least 384K RAM, 180K more than 4.2. You might get away with 552K of disk space to install 5.0, but reserve a few megabytes if you have a LaserJet or PostScript printer, because you'll definitely want to install Fontware.

Users of the initial May 5 release of 5.0 reported problems with everything from tutorial installation and mismatched program files to problems with Plus Development Hardcards and early Compaq ROM chips. These were all fixed by the July 11 release, so those wary of technology's bleeding edges can relax. Version 5.0 is not only not a beta release, but it is also extremely well conceived and remarkably stable for its complexity. Although any product of this size should be allowed a few anomalies and limitations, no bugs remaining from the initial release of 5.0 were uncovered in preparing this article.

The Import File Size test measures in bytes the final imported file size of a 50K document after it has been brought into a program's own environment. Programs manipulate files differently—for example, in the way they insert formatting codes into the document—hence the variance in imported file sizes.

The Document Manipulation tests measure the time it takes a word processor to load and save a file. Document Load measures the time it takes to call up the file imported in the Import File Size test; Save and Resume measures the time it takes a program to save the same document and return control of the keyboard to the tester.

The Global Search and Replace test measures how long it takes a word processor to replace 115 cases of the word his with the word there.

The Cursor Movement tests determine how long it takes to move the cursor through a document. The

Cursor Top-to-Middle test times the jump from the top, or Home position, to a predefined point in the middle of the document. The Cursor Middle-to-Bottom test times the jump from the midpoint to the bottom, or End position, of the document.

The Search for Middle test measures the time it takes to find a sentence placed in the exact middle of the document. Since some word processors cannot search for an entire sentence, the test allows for searching on a keyword or string of words.

The Block Manipulation test is based on two separate timings. The Block and Move test records the software's ability to define, or highlight, the first three pages of the test document and then move this block to the center of the document—somewhat like a cut-and-paste operation. This test moves but does not delete the text. The Block and Copy test takes the same three-page block and copies it to an external file. Both tests require large-scale page reformatting that slows the performance of some

programs, depending on how well they handle the task in a RAM buffer. The larger the buffer, the faster the results.

The Merge test times the program's ability to import an external file to a point immediately following the middle of the document file. The external file consists of the first three pages of the original document. Again, page reformatting affects the performance results.

The Text Delete test times how long it takes to define and delete the file that the Merge test imported and inserted into the document. Again, this procedure requires significant page reformatting, and the program's buffering capability greatly affects performance.

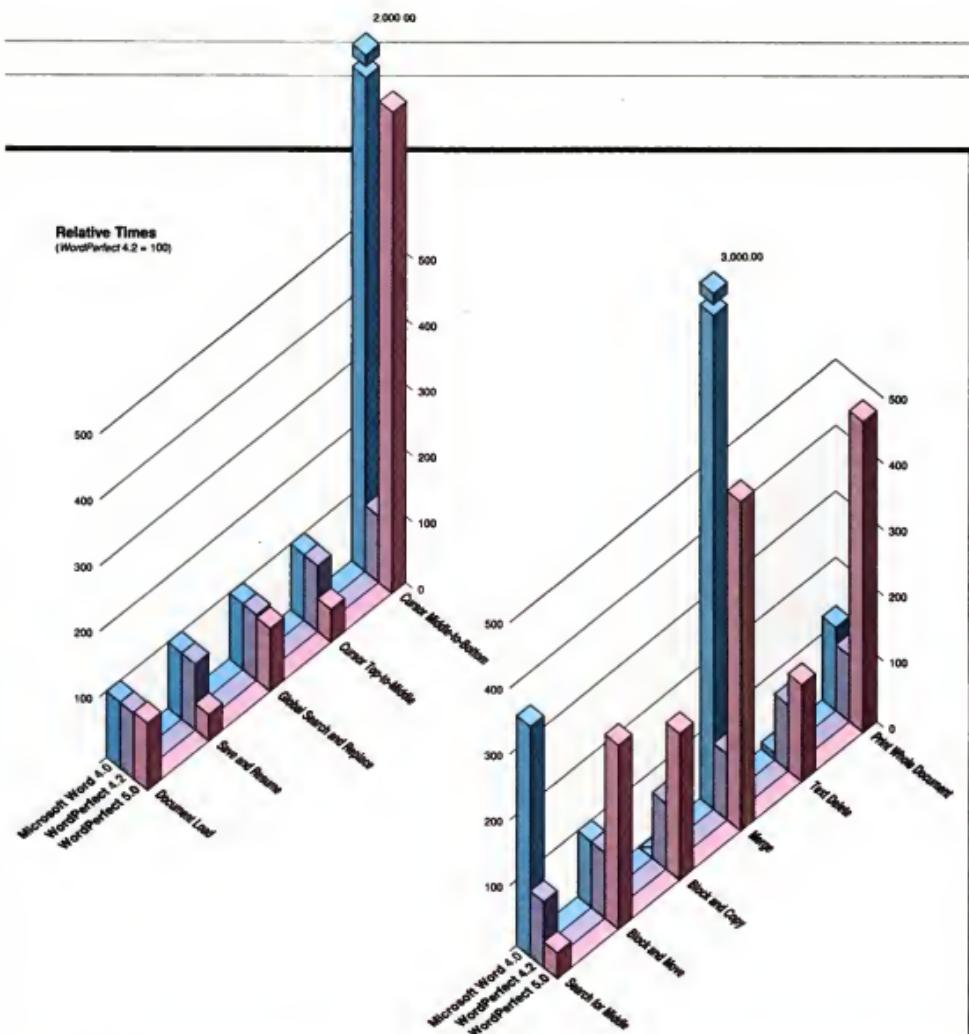
The Print Whole Document test uses a 1MB RAMdisk and times the program's ability to print the entire 50K test document to an external file.

Performance Times
(Times given in seconds)

	Import File Size (bytes)	Document Load	Save and Resume	Global Search and Replace
Microsoft Word 4.0	50,176	1.00	3.00	6.00
WordPerfect 4.2	50,000	1.00	3.00	6.00
WordPerfect 5.0	49,604	1.02	1.20	5.75

N/A—Not applicable; function not available.

*Results for this test were published incorrectly in the February 29, 1988, issue.



Cursor Movement

Cursor Top-to-Middle	Cursor Middle-to-Bottom	Search for Middle	Block and Move	Block and Copy	Merge	Text Delete	Print Whole Document
0.10	2.00	7.00	0.10	N/A	3.00	0.10	35.00
0.10	0.10	2.00	0.10	1.00	0.10	1.00	27.76*
0.05	0.73	0.78	0.28	2.23	0.50	1.47	131.02

WORDPERFECT 5.0



WordPerfect 5.0's new macro editor allows you to pick functions from a scrolling light-bar menu. The macro shown, which has been assigned to Ctrl-C, implements a simple on-screen calculator.

ity around, you could easily use it to edit the font table for that wheel and adjust the spacing you needed for each letter.

You got into trouble, however, when you mixed fonts on the same page. A paragraph of monospaced type often landed on a different right margin from a paragraph of proportional type, even when the effective margins and (average) pitch were identical. The same deviation was common with two proportional fonts. But the biggest problem was changing fonts within a line: no amount of experimentation ever got the right-hand margins to align.

While this one technological snafu drove thousands of *WordPerfect* users to *Microsoft Word* and other competitors, WP 5.0 changes all this. Measurements are now specified as inches, centimeters, or points from the page edge—so if you switch fonts, use a different form, or change orientation from portrait to landscape, you still get good margins.

PRINTER THERAPY Although hundreds of printers come with fully fleshed-out drivers, you can easily reprogram your

printer with the technologically groundbreaking PTR.EXE program, which is new in 5.0. This menu-driven monster—200K all by itself—is more powerful and complex an application than are many of the word processors with which *WordPerfect* competes. PTR compiles drivers consisting of scores of miniprograms, which emit printer control strings operating with their own runtime Pascal-like language, using variables, mathematical operators, and true programming constructs.

Documentation for PTR was completed late but is now available; it costs \$15 extra. Although all printer drivers have been completely regenerated by PTR, all those old daisy wheel and dot matrix jalopies are fully supported in the new scheme and may even work better than before.

Version 5.0 of *WordPerfect* supports an official 1,702-member "WordPerfect Character Set" divided into 13 groups: ASCII, Multinational 1, Multinational 2, box drawing, typographic symbols, iconic symbols, math/scientific, math/scientific extension, Greek, Hebrew, Cyrillic, Japa-

nese Kana, and user-defined characters. The new standard will be a boon to those who felt hindered by the absence of such characters as the bowtie, bent radical, sad face, and *mjakik znak* (the soft sign, or palatization symbol).

Printer independence for most word processors means that if you underline a block of text, the program will translate the request for any printer it supports. In 5.0 you select a target printer and the printer's base fonts, but after that it will shield you from any environmental hardship you can imagine. If you move your document to a workstation attached to a different printer, 5.0 will substitute a font that best fits the one you originally chose.

STYLE CONSCIOUS Advanced 4.2 users simulated the coveted style sheets of *Microsoft Word* via macros, but changing a style had to be done manually since you couldn't do a global replace on the second of a code pair. Although 5.0 lets you do such a replace, you won't bother—a powerful new style facility is solidly in place.

Styles can contain any formatting code and either apply to a specific block of text or change the format for the document from that point forward. You can create a style manually or by example, and you can edit it easily. Since *WordPerfect* documents are never dependent on secondary files, styles are always saved in your document. But they can also be saved to a disk file. You can specify a global style library to import when creating new documents.

Styles are so easy to change that you can, for example, precede chapter headings by the text "Chapter n:" shown centered and extra large, and added to the table of contents. Later, if you decide to feed the document to *Ventura Publisher*, you could edit the style to precede the chapter headings with the text "@CHAPTER =", so that the analogous *Ventura* styling would take effect. (For now you'll have to export a text file to *Ventura*, since neither *Ventura*—until the newly released Version 2.0—nor *WordPerfect* 4.2 understands 5.0 styles.)

WordPerfect's styles are in fact more powerful and flexible than those of most high-end desktop publishing programs. *Ventura Publisher* styles, for example, are limited to paragraphs. (Although *Ventura*

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*"Just Released for OS/2!
SuperProject Expert/2"*

New... SuperProject Software What The Experts Have To Say:

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Construction: "The familiar SuperCalc® and 1-2-3 menu system makes it really easy to learn and use. It handles multiple projects, networking and flexible

report writing. The multiple resource calendars and histograms manage resources very efficiently." Ted Ritter, CEO, O'Connor Construction Co.

Data Processing: "The Outliner allows me to quickly sketch critical schedules from the top down. Expert is way ahead of the pack." D.W. Nesper, Regional Consulting Manager, Wang Labs.

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Resource Histogram	No	Yes	Yes
Resource Leveling	No	Yes	Yes
Tasks Per Project (Max)	1,560	2,550	Undetermined
Mainframe Link	Yes	Yes	Yes
Calendars	No	Yes	Yes
Export Import (Partial or All)	No	Yes	Yes
Multi-Project Resource Pooling	No	Yes	Yes
Network Configuration Output	No	Yes	Yes
Screenprinting	No	Yes	Yes
Printer Support	No	Yes	Yes
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■ WORDPERFECT 5.0

ra's definition of a paragraph can be stretched, your source files must still keep each paragraph separate even when it's just a corporate name.) In *WordPerfect* you can examine all your settings for a particular style on one Reveal Codes screen; in *Ventura* you have to wander through half a dozen menus trying to remember which setting deviates from the norm.

MACRO LEAPS The macro facility of 4.2 did little more than remember a series of keystrokes and play them back for you. Here again, 5.0 has made a leap by offering a powerful new set of macro functions selectable from within an on-line editor. This editor lets you write not only macros but also keyboard layouts that change the default function key assignments. The macro language available from within the

- *WordPerfect* 5.0 offers a powerful set of macro functions selectable from within an on-line editor.

new editor includes arithmetic and logical expressions, assignment of variables, program structuring, exception handling, macro nesting, and keyboard input.

Ctrl-PgUp, which was undocumented in previous versions of *WordPerfect*, now has three uses. During normal execution, it acts as a quick glossary key: it prompts you for a single digit, *n*, and then a character string; thereafter, pressing Alt-N causes the entire character string to be typed back for you. If you've marked a text block, Ctrl-PgUp will prompt for the digit alone and automatically assign the block's contents to Alt-N. And pressing Ctrl-PgUp while editing a macro lets you pick functions to insert in your macro definition from a bouncing light-bar menu.

Version 5.0's macro documentation isn't really there yet, but you do get a sample macro library that will give you plenty of ideas. *WordPerfect* is now a truly extensible product—that is, you can trigger macros that will make anyone think he's

seeing the program's next beta release.

WordPerfect is a massive and complex marriage of diverse functions, competing interface strategies, and debatable design compromises. It is fecund, not sexy.

The more the program improves, however, the more there will be to improve. And *WordPerfect* Corp. has a bad habit of not fixing mistakes that heavy users have gotten used to, like assigning the help

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function to F3 instead of F1 where it belongs. Insisting on F1 for Cancel and Esc for the obsolete repeat function is almost as funny as Microsoft's claim that *Word's "Alpha"* was a real command. Anyone who wants to believe *WordPerfect* 5.0 is without chinks in its armor should bear in mind the following caveats:

■ For one, *WordPerfect* is the only serious word processor that fails to warn you when you're about to write over an existing document. Instead of distinguishing between updating a document you just loaded (which doesn't need a warning) and replacing a document you may not know about (which does), *WordPerfect* issues in each case the same perfunctory reminder—a message that becomes too familiar to be taken seriously until it's too late.

■ When changing the format of your document, you shouldn't have to search through lists of format codes whose mnemonics you don't have time to memorize.

Microsoft Word doesn't make you look under the hood and be your own mechanic just to unboldface or uncenter a bit of text.

■ And if you do have to look under the hood, you should at least be able to control the size of the window. A three-line Reveal Codes window might be useful enough to leave on screen, but the mandatory 12-line blizzard is distracting.

LOOKING BACKWARD *WordPerfect* Corp. should have planned for backward compatibility years ago. It's just now getting the idea. Only in 5.0, for example, is there a document prefix that tells what version of *WordPerfect* the document was prepared with, and only Versions 4.2 and 5.0 are able to check for this prefix. Version 4.2 will simply refuse to process a prefixed document; Version 5.0 will add the prefix if it's missing. It should have been easy to assign document format code identifiers serially, so that if a 4.2 workssta-

tion inherited a 5.0 document, it would know enough to ignore all codes above, say, 0x42FF. *PageMaker* and *Ventura Publisher* would then be able to import text from any future release of *WordPerfect* because they would know which codes to ignore. For now, if you want to prepare input for third-party programs, you'll have to save the document in 4.2's format and keep your fingers crossed.

Believe it or not, 5.0 still doesn't have features that allow you to show different parts of the same document in two windows; divide the windows vertically or have more than two of them; sort directories by extension, size, date, or summary data; have footnotes in a multicolumn page or balance the columns on the last page; or obtain context-specific help in the middle of a menu.

And it certainly would be nice to be able to see on line 25 the current format code mnemonic so that you don't have to

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■ WORDPERFECT 5.0

toggle into the Reveal Codes screen to find out why your cursor doesn't move when you cursor-left 18 times; to mark text that is exempt from spell checking so that you wouldn't have to add *mjakij znak* to your dictionary; to search and replace attributes like underline or italic directly rather than looking for the codes that turn them on or off; to see in the document summary how often your document has been modified and by whom; to add text to a table of contents entry that doesn't appear in the chapter heading, as you can in *Microsoft Word*; or to have new system variables like the document filespec or the fields in the document summary.

NEW STANDARD Although Version 5.0 sets a new standard in word processing excellence, there are two alternatives that you should evaluate if your needs diverge from the mainstream. The first is high-end desktop publishing, currently dominated

by familiar products like *PageMaker* and *Ventura Publisher*. If you never use words in a sentence, like to hang out with the visual crowd, or truly require impeccable design and layout, by all means add a desktop publishing program to your system. You can still prepare your text in an ordinary word processor or, if you choose 5.0, an extraordinary one.

The other direction to think about is an academic word processor like *Nota Bene*, a marriage of *XyWrite III Plus* and *FYI 3000 Plus* (a textbase manager).

For the vast majority of us, however, Version 5.0 makes *WordPerfect* even more of a daily necessity. We'll soon see how great a threat *Microsoft Word* 5.0, due for release later this year, will pose to *WordPerfect*, but 300,000 copies of 5.0 had been shipped within 8 weeks of the initial May 5 release.

WordPerfect Corp. also has proven that it listens to its users. In fact, the company

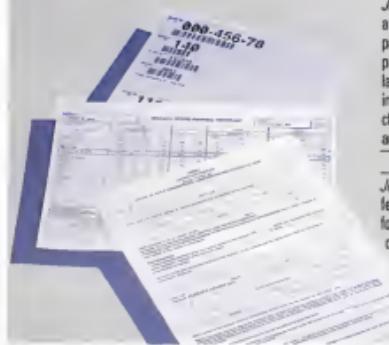
has announced that if users with small systems prefer to stay with 4.2, the company will continue to develop both versions independently. In any case, 4.2 will be supported at least through 1990.

Best of all, *WordPerfect* is already gearing up to leave forever the prehistoric swamp of character-based applications and evolve into a graphically elegant mouse-driven creature. Earlier in the year it successfully migrated to the Macintosh. An OpenLook variant is being developed for Unix, and an OS/2 Presentation Manager version is scheduled for delivery in 1989.

If *WordPerfect Corp.* can steal enough features from *PageMaker* and *Ventura Publisher* by then, it may find entirely new niches to dominate in the 1990s.

Dean Hannotte is a data processing consultant with 20 years' experience on mainframes, minicomputers, and PCs.

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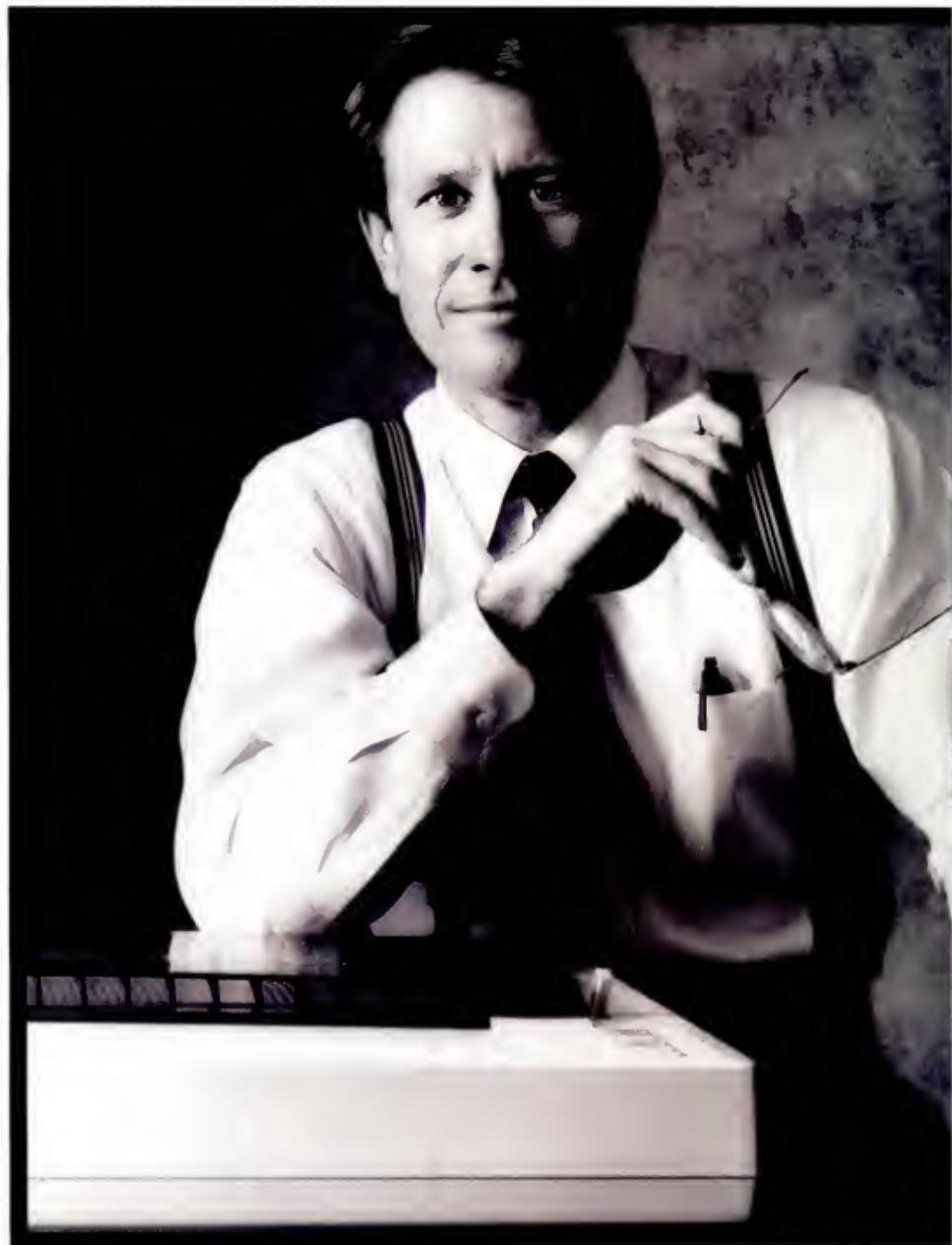
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Beware the creeping megahertz. What was once awe-inspiring becomes mundane with frightening speed—and that's good. Once upon a time (not very long ago), the fastest personal computers you could buy were equipped with 80386 microprocessors running at 20 MHz. Almost surreptitiously, a new group of computers with that speed rating have slipped onto the market. Already they promise to become the most popular high-performance computers sold. The 20-MHz mark is today's expected speed level for an 80386-based machine.

Driving the upward creep of the megahertz is the rising availability of 80386 microprocessors bearing the 20-MHz rating. Scarcity breeds higher prices, but the

There's a new standard in the computer marketplace: the 20-MHz 386. And with that standard comes a plethora of new PCs, all competing with high-quality components, low prices, and innovative designs to pull out from the crowd at the high end of the marketplace.

shortage of such chips is over. Instead of fighting over quotas on the number of chips to be delivered, computer makers can now bicker about microprocessor price. Where once there were too few computers and too much demand, now you can step into a store and buy a 20-MHz 80386 without staring down the long, dark length of a back order.

To be sure, top-of-the-line machines that are trying to push the speed limit up to (and beyond) 25 MHz still command premium prices. The necessary 80386 microprocessors and support chips bearing that speed rating remain in short supply—to the point where pushing up performance that last notch will cost you several thousand dollars more.

On the other hand, the slightly slower competitors we will examine rate as some of the best buys on the market. They give you all the special abilities of the 80386 chip and more than enough performance to serve in nearly any single- or multiuser application.

TREND TOWARD DIVERSITY Diversity is one trend among these new 20-MHz computers. While once only a scant few manufacturers dared tangle with the troublesome 20, the number of makers of such machines is ballooning. A new cadre of smaller vendors has moved into the territory, touting the kind of bargain prices that have now become rampant in the AT-compatible market.

Ready access to the higher-speed chips is one reason. Another is a growing wealth of system boards available to smaller computer makers. While the big-name brands—Compaq, Dell, AST Research, and now Everex, Acer, and ALR—have the wherewithal (and engineering teams) to develop their own system boards, most of the lesser-known computer makers do not. The latter rely on system boards produced by other companies that specialize in that technology.

The number of available 80386-based system boards has dramatically increased, and their complexion has changed. What was once the mainstay of most 80386-based computers—Intel's own system board—doesn't appear in any of these machines. In its stead, a number of new system boards are elbowing their way into new system units and, their makers hope, into your heart.

This diversity of system boards breeds yet another diversity. Where once 80386 computers were all much the same in terms of performance and architecture, the newer machines are beginning to reveal the individuality of their makers. Gone are the days when most machines scored identically on benchmark tests because their uniqueness was only skin-deep. Nearly every reasonable speed-optimization strategy is represented in this selection of 20-MHz machines.

The top performers are uniformly based on cached memory. The Dell System 310, Everex STEP 386/20, and 386/20 Northgate Power all exploit caching to push their

WHEN IS A COMPUTER OS/2 COMPATIBLE?

Compatibility has always been one of the driving forces in the industry that has grown up around the IBM PC. In general, IBM has set the standards, and most other manufacturers have taken great pains to make their computers compatible with the IBM machines. A typical compatible can run most DOS application programs written for the IBM PC and—in many cases—can even run IBM's version of DOS.

THE MONKEY WRENCH OS/2 throws a monkey wrench into the common notion of PC compatibility. The new operating system depends much more on the hardware of the computer than DOS applications or DOS itself did. In short, a non-IBM machine that is compatible enough to run IBM's version of DOS may not be compatible enough to run IBM's version of OS/2.

This phenomenon can be explained by focusing on one part of the PC that is often implemented quite differently by various manufacturers: the hard disk controller. Manufacturers of PC compatibles do not need to make hard disk controllers that are hardware compatible with those found in IBM machines. DOS application programs don't directly access the

memories near the zero-wait-state limit. Backing its cache with high-speed main memory, Dell earns top honors and the Editor's Choice, while the Everex with its scalable cache runs neck and neck with most of the Dell timings. Using a cache unembellished by such refinements, Northgate trails the leaders only slightly, still ahead of computers that use relatively staid memory techniques. Other makers opt for slower, easier-to-develop techniques, such as interleaving their RAM, opting for page-mode access, or both.

TRICKY RESPONSE TIMES Besides speed, these new computers show another new trend: an emphasis on responsiveness.

hard-disk-controller hardware. Instead, programs make function calls to DOS when they wish to use files on the hard disk. And DOS doesn't access the hard-disk-controller hardware, either. DOS calls routines in the ROM BIOS when it must read and write sectors on the hard disk.

In most cases, only the ROM BIOS must deal directly with the hard-disk-controller hardware. Because the ROM BIOS is located on the system board (or the hard-disk-controller board), it is inherent in the hardware architecture. Manufacturers of PC compatibles need only ensure that the software interface provided by the ROM BIOS is compatible with IBM's BIOS. (How the ROM BIOS and the hard disk controller actually work doesn't affect compatibility.)

Thus, many PC compatibles can still run IBM's version of DOS even though they are incompatible with the IBM PC on the hardware level. Any variations in hardware design are hidden away from DOS in the ROM BIOS.

Not so with OS/2. OS/2 uses the 80286 and 80386 microprocessors in protected mode. The ROM BIOS routines are written for real mode and will not operate in protected mode. There-

A computer that reacts to your commands more quickly will seem faster regardless of the speed at which it actually executes your programs. The AT&T 6386 WorkGroup System, for example, is one of the slowest in benchmark testing among the machines included here, yet it seems at least as fast as most because both its disk and display respond very quickly.

Computer makers have adopted two techniques to improve the responsiveness of their systems. One of these is the same strategy used by IBM in the original AT—the fast hard disk. A large number of these 20-MHz machines have disks with average access times of 20 milliseconds or less, half the time required by the AT drive

fore, OS/2 cannot use the BIOS.

Instead, OS/2 must include its own code (sometimes in the form of OS/2 device drivers) for accessing all the hardware of the computer, including the hard disk controller. This code must be written for specific hardware designs and configurations. OS/2 cannot deal correctly with those variations in hardware design that it is not coded to handle.

OS/2 ADAPTATION Many manufacturers of compatibles will need to configure a version of OS/2 for their own hardware. To do this, they must enter into a licensing agreement with Microsoft to create an OEM (original equipment manufacturer) adaptation of OS/2. The manufacturers receive an OEM adaptation kit from Microsoft that allows them to modify hardware-dependent code in OS/2 or to write their own device drivers. Each manufacturer then sells its own adapted version of OS/2 to its customers. This is essentially the same arrangement that an OEM makes with Microsoft to sell DOS, but many manufacturers don't have to bother with it because IBM's version of DOS runs on their machines.

If you are interested in running OS/2 on a non-IBM machine, you should stick

to manufacturers that have adapted OS/2 for their compatibles or at least are planning to. Otherwise, you have no real assurance that you will ever be able to run OS/2 on your machine.

This is true also for hardware peripherals such as video boards and external mass-storage devices, including CD-ROM drives and tape backup systems. Some of these peripherals will require different OS/2 dynamic-link libraries or device drivers—which should be provided by the manufacturer.

The good news is that OS/2 applications should encounter very few compatibility problems. While DOS applications frequently access the hardware of the video display, keyboard, and RS-232 serial ports (and thus are dependent on this hardware), OS/2 has application program interfaces (APIs) for all these devices. The OS/2 Presentation Manager (included in OS/2 1.1) includes a device-independent interface for graphics displays and printers.

This means that most OS/2 applications will run the same on any machine that can run OS/2, regardless of the machine's hardware design. OS/2 assumes the entire burden of hardware compatibility, and OS/2 applications are written

for the operating system rather than for the hardware.

As OS/2 assumes a significant market share in the years ahead, we'll probably see two very different trends in hardware design. Some smaller manufacturers may create "ultra-clones"—machines designed to be so compatible with IBM's hardware that they can run the IBM version of OS/2. (Any non-IBM machine that can run IBM OS/2 today does so by accident and not by design.) These manufacturers can avoid doing their own OEM adaptation.

More-adventurous manufacturers may take a different approach. Because OS/2 applications are written for the operating system rather than for the hardware, and because OS/2 can be configured for different hardware designs, manufacturers are liberated from the need to maintain compatibility with IBM hardware. Thus, innovative manufacturers can create computers that are not at all compatible with IBM on the hardware level but are able to run an adapted version of OS/2 and OS/2 applications.

—Charles Petzold

Charles Petzold is a contributing editor of PC Magazine.

(in keeping with their twice-as-fast-or-more microprocessors).

Disk can also be made more responsive by caching, a technique successfully employed by IBM and Compaq. Inexplicably, only a few of these machines include disk-caching software as standard equipment.

Of course, average access time is not the only criterion of merit for a disk drive. The data transfer rate also influences overall system performance. A faster average access time (or a disk cache) will make the system seem faster as it races more quickly through tasks that involve reading or writing many short records to disk. And a higher data transfer rate will improve the

handling of longer files and the loading of larger programs.

To increase the data transfer rate, a growing number of high-speed computers are relying on newer disk interfaces and data coding methods. Several of the computers tested here take advantage of the higher transfer rate of the Enhanced Small Device Interface (ESDI) and Run Length Limited (RLL) data coding.

Other factors besides interface and coding also influence disk performance. The oft-cited transfer rate represents only the time devoted to moving data between the disk drive and its controller. Speed can be increased at other places in the computer system. For instance, both the computer

bus speed and the speed of the direct memory access (DMA) controller determine how quickly information can be shuffled among controller, memory, and microprocessor. Microprocessor speed and the number of memory wait states also influence this aspect of disk performance; a faster machine can absorb data from disks more quickly.

HIDDEN ROM DELAYS Another way the makers of 80386-based computers are improving the responsiveness of their systems is by "shadowing" the BIOS firmware contained in the read-only memory (ROM) of their systems. While the main memories of these computers can be read

■ 20-MHz 386s



20-MHz 386-based PCs: Summary of Features

(Products listed in ascending base-price order)

The following definitions explain the terms and analyze the aspects represented in this table of features. The phrases are listed in the same order as in the left-hand column of the table.

Basic configuration Because hardware vendors frequently offer a choice among various hard disk drives and monitors—at different prices—we are reporting the price of a completely stripped-down model as a "basic" configuration. Note that all computers in this roundup are equipped with some version of the IBM Enhanced-style keyboard, which is why the question of keyboard design does not appear in the table.

Software Included Hardware manufacturers may or may not bundle software with their computers. Bundled software may include DOS, disk caching programs, setup and install programs, and various utilities. DOS is often available only at an additional cost.

Reset switch Many computers now come with a reset switch allowing a cold reboot of the computer. This switch saves wear and tear on the power switch.

Bus clock speeds (MHz) Bus speed becomes more important as computers run at faster clock speeds. A computer's bus speed may actually be too fast for expansion cards, most of which operate at 8 or 10 MHz. Timeout periods, sometimes called wait states, are often used to slow down the bus.

Disk controller manufacturer/type

Several interfaces are used to control the way data is transferred from the hard disk to the computer. The most common disk interface standard is the ST-506/412, used in the IBM PC-XT and PC AT. Two other common data transfer interfaces are SCSI (Small Computer System Interface) and ESDI (Enhanced Small Device Interface). Both SCSI and ESDI require special hard disk controllers and cannot run off existing PC-XT or PC AT controllers.

Disk encoding techniques currently include RLL (Run Length Limited) and the older MFM (Modified Frequency Modulation) scheme. All data is encoded onto and read from your hard disk as a series of polarity-reversing bits representing ones and zeros. Nine such bits would be needed to store 12 bits of data in MFM format, and only six

polarity changes are required with RLL format; thus, MFM takes more space than RLL but provides a more stable environment and is more commonly used. ST-506 technology, for instance, uses the MFM encoding scheme.

BIOS version and date The BIOS date is important to those planning to use 3½-inch disk drives. Earlier BIOS versions cannot handle this format.

Chip packaging Memory chips come in a variety of styles: DIPs, SIPs, and SIMMs. The Dual In-line Package (DIP) is the traditional buglike computer chip sprouting 8, 14, 24, or even 40 or more metal legs (evenly divided between right and left sides). Single In-line Packages (SIPs) are single-package arrays of computer chip logic assembled so that all connecting legs are in a straight line, like the teeth on a comb. Single In-line Memory Modules (SIMMs), on the other hand, are individual logic devices that are installed on their own small circuit board, creating a component module that can be plugged into a larger device. Their physical arrangement duplicates the integrated structure of a SIP but allows for the possibility of replacing an

BASIC CONFIGURATION	VIPC Hybrid	CPU 386/20	PC Link 386-20	Amaz PC/386 Business System	Micro Lab 386	Everest 386/20
List price	\$1,999	\$2,095	\$2,495	\$2,565	\$2,797	\$2,995
RAM	1MB	1MB	1MB	1MB	1MB	2MB
Floppy disk drives	One 1.2MB 5½-inch	One 1.2MB 5½-inch	One 1.2MB 5½-inch or one 1.44 3½-inch	One 1.2MB 5½-inch	One 1.2MB 5½-inch	One 1.2MB 5½-inch
Hard disk drive	None	None	None	None	None	None
Drive bays	Three half-height, one full-height	Five half-height	Five half-height	Five half-height	Five half-height	Three half-height
Software included	Setup, utilities	Setup	Setup, diagnostics, utilities, disk cache	Setup, diagnostics	Setup, utilities	Setup, diagnostics, DOS 3.3
OS/2 supplied	○	○	○	○	○	○
Monitor	None	None	None	None	None	None
Ports	2 serial, 2 parallel	2 serial, 1 parallel, 1 game port	1 serial, 1 parallel	1 serial, 1 parallel, 1 game port	2 serial, 2 parallel	2 serial, 2 parallel
Slots	One 8-bit, six 16-bit, one 32-bit	Two 8-bit, five 16-bit, one 32-bit	Three 8-bit, four 16-bit, one 32-bit	Two 8-bit, five 16-bit, one 32-bit	One 8-bit, six 16-bit, one 32-bit	Four 8-bit, three 16-bit, one 32-bit
32-bit bus manufacturer	Advanced Micro Research	Chartered Electronics Industries	Hauppauge	Compaq	Advanced Micro Research	CMP Enterprise Co.
Power supply (watts)	200	204½	220	200	200	200
Reset switch	●	●	○	●	●	●

—Editor's Choice ●—Yes ○—No N/A—Not applicable; product does not have this feature.

individual memory components, DIPs, SIPs, and SMTs, circuit boards in several repair time comes. These chips can be speedier, but suffer because of a points. Soldered-on chip to move off board to date.

In recently employed bulky heat sinks, carded, entity is ThinkPad sizes PS

Chip Co.
Chips and
Technologies

256K, 1MB
SIPs

DRAM

○ N/A

16
287 (or 80387
adapter)

\$325
○ None

serial, 1 parallel
20 8-bit, six
8-bit

N/A

200
○

bytes (using row address). Paging is desirable because the 80386 contains a prefetch instruction that allows it to deal with a full page of RAM.

Interleaved memory CPU speed is usually faster than memory speed. Interleaved memory increases processing speed by splitting the memory into two or more portions. The CPU then sends information to a section at a time, allowing one section to process while another receives data.

Shadow RAM Shadow RAM is a technology that loads system BIOS or video BIOS directly into fast RAM on boot-up of the computer. The BIOS then operates much faster.

Cache controller Using a cache controller chip is one method of increasing computer speed via caching. Intel's 82385 Cache Memory Controller is an example of a static RAM cache. (See the sidebar "Working at the Speed of RAM," which accompanies "The Size Is Right: Packing 386 Power into Sleek PCs," PC Magazine, November 15, 1988.)

Cache software Some companies provide their own software to facilitate caching.

Other computers can generally take advantage of the caching facility within some version of DOS.

Maximum 32-bit RAM There is currently no standard for 32-bit cards, and not many cards are available today. Many computer manufacturers, however, have designed their own 32-bit memory expansion cards. 32-bit slots for memory cards are especially important in the era of OS/2, a memory-hungry operating system.

FCC certification class Two classes of FCC (Federal Communications Commission) approval may be given to computers: Class A and Class B. These classes concern levels of radio-frequency interference. With Class A approval, a computer may be operated in a business locale. The tougher Class B rating allows home use as well, where computers may be placed near radios and television sets. Certification tests must be performed by private testing companies. The passing results are then sent to the FCC for final certification, a process taking several months or more.

	Artic 86	Spear 386/20 MHz Tower System	AST Premium/386	386/20 Hercules Power	AT&T 6386 Workgroup System	Everex STEP 386/20	Acer 1100/20
256K, 1MB SIPs	\$4,000	\$4,195	\$4,195	\$4,495	\$4,495	\$6,595	\$6,595
12MB 5½-inch	2MB	1MB	1MB	1MB	1MB	2MB	2MB
Zone	One 12MB 5½-inch	One 1.2MB 5½-inch	One 1.2MB 5½- inch and one 1.44MB 3½-inch	One 1.2MB 5½- inch or one 1.44MB 3½-inch	One 1.2MB 5½-inch	One 1.2MB 5½-inch	One 1.2MB 5½-inch
Six half-height	None	None	68MB	None	None	70MB	70MB
	Five half-height	Three half-height	Five half-height	Three half-height, one full-height	Five half-height	Five half-height	Five half-height
Setup, diagnostics, utilities	Setup, disk cache	Utilities, disk cache, DOS 3.3, GW-BASIC	Setup, diagnostics, disk cache, DOS 3.3	Setup, diagnostics, disk cache, DOS 3.3	Setup, diagnostics, disk cache, Microsoft Windows/ 386	Setup, diagnostics, disk cache, DOS 3.3	Setup, disk cache, DOS 3.3, LHM- 4.0 driver, GW-BASIC, Microsoft Windows/386
\$325 ○ None	Optional (\$325) None	○ 14-inch amber monochrome	○ None	○ None	Optional (\$325) None	○ None	○ None
serial, 1 parallel 20 8-bit, six 8-bit	1 serial, 1 parallel Two 8-bit, six 16-bit	1 serial, 1 parallel One 8-bit, six 16- bit, one 32-bit	2 serial, 1 parallel Two 8-bit, one 16-bit, three 16-bit, one 32-bit	1 serial, 1 parallel Two 8-bit, six 16- bit	1 serial, 1 parallel Two 8-bit, two 16- bit, three 32-bit	1 serial, 1 parallel One 8-bit, six 16- bit, one 32-bit	2 serial, 1 parallel Two 8-bit, five 16-bit, one 32-bit
N/A	N/A	Everex	AST	N/A	Olivetti	Everex	Acer
200 ○	204½ ●	200 ●	220 ●	192 ●	230 ●	200 ●	200 ●

■ 20-MHz 386s



20-MHz 386-based PCs: Summary of Features

(Products listed in ascending base-price order)

CONFIGURATION TESTED	VIPC Hybrid	CPU 386/20	PC Link 386-20	Amaz PC/386 Business System	Micro Lab 386	Everest 386/20
List price	\$5,999	\$4,725	\$5,195	\$3,495	\$3,697	\$4,165
Upgrades and additions to the basic configuration	4MB RAM, 80MB hard disk and 80MB floppy, 1.44MB 3½-inch disk drive, EGA/VGA monitor, 80387 coprocessor, tower case	2MB RAM, 40MB hard disk, VGA card and monitor, 80387 coprocessor	90MB hard disk, one 1.2MB 5 ¼-inch and one 1.44MB 3½-inch disk drives, VGA card and monitor, 80387 coprocessor	40MB hard disk, EGA card and monitor	40MB hard disk, EGA card and monitor	40MB hard disk, EGA card and monitor
Microprocessor clock speeds	8/20 MHz	8/20 MHz	20 MHz	8/8/10/20 MHz	8/20 MHz	24 MHz
Wait states	0	0	0	0	0	0, 1
Bus clock speeds	8 MHz	8 MHz	8 MHz	10 MHz	8 MHz	12 MHz
Disk controller manufacturer and type	Western Digital (ST-506)	NCL (ST-506)	Western Digital (ESDI)	Western Digital (ST-506)	Western Digital (ST-506)	CMP Enterprise Co. (ST-506)
System drive capacity	Controller card handles 2 floppy and 2 hard disk drives	Controller card handles 2 floppy and 2 hard disk drives	Controller card handles 2 floppy and 2 hard disk drives	Controller card handles 2 floppy and 2 hard disk drives	Controller card handles 2 floppy and 2 hard disk drives	Controller card handles 2 floppy and 2 hard disk drives
BIOS version and date	Quadtel, Version 2.21 (July 1986)	AMI BIOS (May 1987)	Award BIOS, Version 3.01 (April 1987)	Award BIOS, Version C3.03 (1987)	Quadtel, Version 2.21 (August 1986)	AMI BIOS (February 1986)
System board manufacturer	Advanced Micro Research	Chartered Electronics Industries	Hauppauge	Amaz	Micro Lab	CMP Enterprise Co.
386 chip set manufacturer	Chips and Technologies	Chips and Technologies	Chips and Technologies	Intel	Intel	Chips and Technologies
MEMORY SPECIFICATIONS						
Memory chip type	256K	256K, 1MB SIMM	256K	256K	256K, 1MB SIMM	256K, 1MB SIP
Chip packaging	SIMM (first 1MB), DIP (upgrades)	SIMM	DIP	DIP	DIP	SIP
RAM chips	DRAM	DRAM	DRAM	DRAM, SRAM	DRAM	DRAM
Interleaved memory	●	●	●	○	●	●
Shadow RAM	●	●	○	●	●	○
Type of cache controller	N/A	N/A	N/A	N/A	N/A	N/A
Cache software	○	○	●	○	○	○
Maximum RAM on motherboard	2MB	6MB	1MB	2MB	2MB	8MB
Maximum 32-bit RAM	16MB	16MB	11MB	6MB	16MB	6MB
Math coprocessor supported	80287, 80387	80287, 80387	80387	80287 (or 80387 with adapter)	80287, 80387	80287 (or 80387 with adapter)
OTHER						
Warranty	1 year	1 year	1 year	1 year	1 year	1 year
FCC certification class	B	A	A	A	B	A

Editor's Choice ●—Yes ○—No N/A—Not applicable; product does not have this feature.

Computer Components Heritage 386/28		Dell System 318	Whole Earth 28MHz 386 Tower	Spear 386/20 MHz Tower System	AST Premium/386	386/28 Neighbors Power	AT&T 8308 WorkGroup System	Everex STEP 386/28	Acer 1100/28
\$6,927	\$5,399	\$5,847	\$5,245	\$9,585	\$4,499	\$6,983	\$6,503	\$8,545	
150MB hard disk, one 1.2MB 5 1/4-inch and one 1.44MB 3 1/2-inch disk drives, EGA card and monitor, 80287 coprocessor	90MB hard disk, one 1.2MB 5 1/4-inch and one 1.44MB 3 1/2-inch disk drive, VGA card and monitor	44MB hard disk, 80387 coprocessor, VGA card and monitor, mouse, memory manager, DOS 3.3, Menu Blocks	71MB hard disk, 1.44MB 5 1/4-inch disk drive, EGA card and monitor	2MB RAM, 90MB hard disk, EGA card and monitor	VGA card and monitor	2MB RAM, 90MB hard disk, EGA card and monitor, 80387 coprocessor, DOS 3.2, mouse	2MB RAM, 80MB hard disk, EGA card and monitor	80MB hard disk, VGA card and monitor	
620 MHz	4.77/6/20 MHz	8/20 MHz	8.7/10/20 MHz	4.77/6/20 MHz	8/20 MHz	6/20 MHz	6.67/10/20 MHz	4.77/6/16/20 MHz	
0, 1 12 MHz	0 8 MHz	0	0, 1 8.7/10 MHz	0, 1 8 MHz	0, 1 10 MHz	1	0 8/10 MHz	1 8 MHz	
Data Technology (ESDI)	Western Digital (ESDI)	Western Digital (ESDI)	Hard disk, Western Digital (WFM); floppy, Universal ACT (ST-506)	Everex (ST-506)	Western Digital (ESDI)	Adaptec (FLL)	Western Digital (ESDI)	SMS (ST-506)	Microplus (ESDI)
Controller card handles 2 floppy and 2 hard disk drives	Motherboard handles 2 floppy and 2 hard disk drives	Controller card handles 4 floppy and 2 hard disk drives	Controller card handles 2 floppy and 2 hard disk drives	Motherboard handles 3 floppy disk drives, 2 hard disk drives	Controller card handles 2 floppy and 2 hard disk drives	Motherboard handles 2 floppy disk drives, 2 hard disk drives	Controller card handles 2 floppy disk drives, 2 hard disk drives	Controller card handles 2 floppy disk drives, 2 hard disk drives	Controller card handles 2 floppy and 2 hard disk drives
Phoenix BIOS, Version 1.02 (January 1988)	Phoenix BIOS, Dell Version 1.04 (July 1988)	AMI BIOS (April 1988)	AMI BIOS, Version F2.31 (February 1988)	AMI BIOS, Version 1.13 (July 1988)	AMI BIOS (June 1987)	AT&T BIOS, Version 1.14 (August 1988)	AMI BIOS (July 1988)	Award BIOS, Version 2.2 (July 1987)	
Tatung	Dell	Myflex	Everex	AST	Myflex	Olivetti	Everex	Acer	
Intel	Chips and Technologies	Chips and Technologies	Spear	AST	N/A (uses discrete logic)	Intel	Everex	N/A (uses discrete logic)	
256K, 1MB SIMM	256K SIMM	256K, 1MB SIMM	256K SIMM	256K, 1MB SIMM	256K DIP	256K SIMM	256K, 1MB SIMM	256K DIP	
DRAM	DRAM	DRAM, SRAM	DRAM, SRAM	Static column RAM	DRAM	DRAM	DRAM, SRAM for cache	DRAM, SRAM	DRAM
● ● N/A	● ● Intel	○ ○ AMI	○ ○ Everex	○ ● N/A	○ ○ Myflex	● ● N/A	○ ○ AMMA	● ● N/A	
16MB 16MB 80287 1167	8MB 8MB 80387, Weitek 1167	8MB 8MB 80387	8MB 16MB 80387	13MB 13MB 80287, 80387 1167	4MB 4MB 80287, 80387 1167	N/A 48MB 80287, 80387 1167	8MB 16MB 80387, Weitek 1167	4MB 12MB 80387, Weitek 1167	
1 year	1 year on-site service	1 year	1 year	1 year	1 year	1 year	1 year	1 year	1 year
B	B	A	A	B	A	B	B	B	B

■ 20-MHz 386s

at high speeds, imposing a minimum of wait states, reading ROM is inherently slower. Not only are many ROM chips confined to lower speed ratings, but most ROM systems are limited to 16-bit bus width, cutting data-moving performance to half the efficiency of 32-bit access to main memory.

Unfortunately, the BIOS code of a computer represents some of the code it

■ The trend among computer makers is to copy the BIOS routines from slow ROM into fast, 32-bit RAM; this copying is called shadowing.

executes most often. Every bit of DOS displayed on the screen, for example, takes a side trip through the system BIOS and its slow ROM routines. Consequently, even the fastest personal computer has to shift into low gear to carry out many of its operations.

The trend among computer makers is to copy the BIOS routines from slow ROM into fast, 32-bit RAM; this copying is called shadowing. The 80386 microprocessor makes the process possible. The firmware routines of the BIOS are copied into a special memory area; then, through the memory-mapping abilities of the 80386, the copy of the BIOS is assigned to the same addresses the BIOS originally used. The original code is switched out of reach.

The potential for ROM shadowing is built into the Chips and Technologies 80386 chip set, which serves as the foundation for many of the computers reviewed here. The Chips and Technologies method, although defeatable, makes shadowing automatic: you don't have to do anything other than boot up your computer to take advantage of it. Other systems, such as the

Amax PC/386 Business System, require your intervention (or that of your AUTOEXEC.BAT file) to relocate the system's BIOS code and enable shadowing.

Either way, the result is the same—snappier system response. DOS operations (especially video writes) and anything else that requires BIOS access are dramatically accelerated. The computer seems more responsive, almost instantly obeying your commands.

Although lengthy, the list of machines reviewed here doesn't include all your options in the 20-MHz 80386 marketplace. Among the first to appear were the Compaq Deskpro 386/20 (reviewed in *PC Magazine*, January 26, 1988) and the IBM PS/2 Model 80-111 (PC Magazine, April 26, 1988). Eleven more contenders were surveyed in the article "20-MHz 386s: Hustle with Muscle" (June 28, 1988), and the November 15, 1988, issue included 20-MHz machines among its selection of small-footprint 386s.

This roundup focuses attention on 20-MHz 386 computers that have not been previously reviewed. Several other models now on the market were unavailable at the time of the review; these included products from Club AT, Delta Computer Corp., and NEC Information Systems.

—Winn L. Rosch

ACER TECHNOLOGIES CORP.

Acer 1100/20

If quantity counted for everything, the amassed quantity of materials shipped with the Acer 1100/20 would certainly give the machine a hands-down first place in the 386 computer Olympics. Along with the system unit and a VGA monitor, we received documentation for every board installed in the computer, an operations manual, MS-DOS manuals and disks, GW-BASIC manuals and disks, and several small pamphlets detailing the use of a few utilities that are thrown in to manage memory and disk caching. The only things missing were the copy of Microsoft Windows/386 that Acer includes with every machine and the mouse that's also a standard component.

The computer itself is sleekly styled off the standard AT flatbed architecture. Round corners and a vent motif inlaid



FACT FILE

Acer 1100/20

Acer Technologies Corp.
401 Charcot Ave.
San Jose, CA 95131
(800) 538-1542
(408) 922-0333

List Price: With 2MB RAM, 70MB hard disk, 1.2MB 5 1/4-inch disk drive, disk cache, MS-DOS 3.3, LIM EMS 4.0 driver, GW-BASIC, Microsoft Windows/386, Acer serial mouse, \$6,695; with 88MB hard disk, VGA card and monitor, \$8,545.

In Short: A technologically sound machine, the Acer 1100/20's performance falls within the mediocre range among 80386-based computers while its price floats in the upper range.

CIRCLE 867 ON READER SERVICE CARD

across the front of the machine emphasize its relatively modernistic appearance. At the left side, a recessed panel holds the cylindrical key lock and status lights that indicate when the fast 20-MHz speed is in effect and whether your hard disk is being accessed.

Around back, the on/off switch perches at the middle of the right side, just above the main power receptacle. You'll also find a separate power tap for a monochrome monitor (as on the old PC-XT systems). Centered at the bottom is the keyboard connector, and adjacent to it are the access bays for interface boards plugged into the eight-slot motherboard.

The keyboard is substantially a standard 101-key model with reasonable tactile response. Acer has carried the LED display one step further, however, including a power-on light along with the more typical CapsLock, NumLock, and Scroll Lock indicators.

Inside the beige case you'll find that the 1100/20 contains a 20-MHz 80386 (older versions of the machine ran at 16 MHz). The test machine received at PC Labs also contained a 20-MHz 80387; alternatively, the 1100/20 will accept a Weitek adapter board.

Acer opted to include an 88MB Micropolis ESDI hard drive in the test unit and deals with it through a separate Adaptec ESDI controller card. The Panasonic

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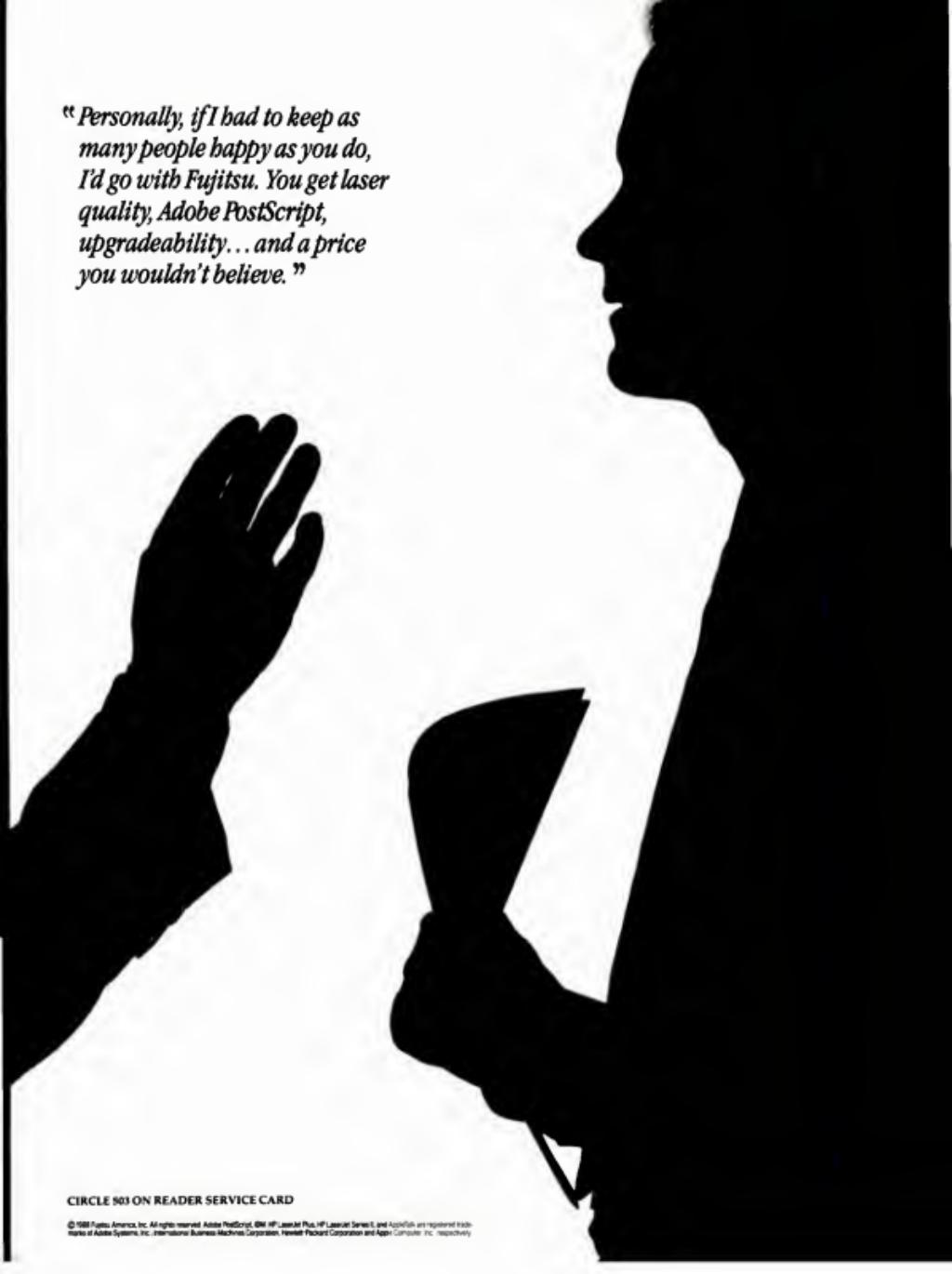
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■ 20-MHz 386s



A moderate performer at a high price, the Acer 1100/20's \$6,695 base configuration includes 2MB RAM, a 70MB hard disk, and no monitor. The machine's math coprocessor socket accepts either an Intel 80387 (shown) or a Weitek 1167.

1.2MB floppy disk drive was driven from a multifunction controller card that also included two serial ports and one parallel. The disk bays have room for two more half-height devices; typically, you'll want to fill them with a 3½-inch drive (to maintain compatibility with the IBM PS/2 world) and, considering the large hard-disk storage found on most 386 systems, a tape backup unit.

A close look at the motherboard reveals a high discrete chip count rather than a sprinkling of VLSIs. System RAM, numbering 4MB in the review machine, is not in the form of the SIMMs more typically seen in 386 equipment. (Note that of the 4MB, 128K is inaccessible, being used as shadow RAM for the ROM BIOS.) From an operational standpoint, there's no difference in RAM workings between SIMM and dual in-line packages, but this, like the overall appearance of the motherboard, bespeaks a delayed transition from the older AT architecture. It looks more like an adaptation than a fresh design.

COMPATIBLE BUS DESIGN Bus speed on the 1100/20 is only 8 MHz, to maintain compatibility with software de-

signed for the slower AT world. Operating speed can be throttled from the keyboard among 20, 8, and 4.77 MHz or (through an included software utility) set to any of several other speeds in between.

PC Labs benchmark tests did bring out a small anomaly that may be due to the way the Acer implements the 8-MHz bus. While bus speed would usually be unnoticeable for most operations occurring on the motherboard (processor activity, RAM access), the 1100/20 ran through the NOP and RAM access benchmarks slightly slower than many of the other machines reviewed. The performance deviation doesn't indicate a considerable speed difference (as might occur if the operating speed were set in the wrong mode), but over the lifetime of the computer, continued incremental differences will add up.

As with most of these new-generation machines, any 1100/20's actual configuration is at the discretion of the buyer. The machine's base configuration is a 70MB hard disk, 2MB RAM, and a 1.2MB floppy disk drive for \$6,695. That puts the machine at the high end of the price category, while its performance remains steadfastly at the middle of the road.—Tom Harding

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■ 20-MHz 386s

AMAX ENGINEERING CORP.

Amax PC/386

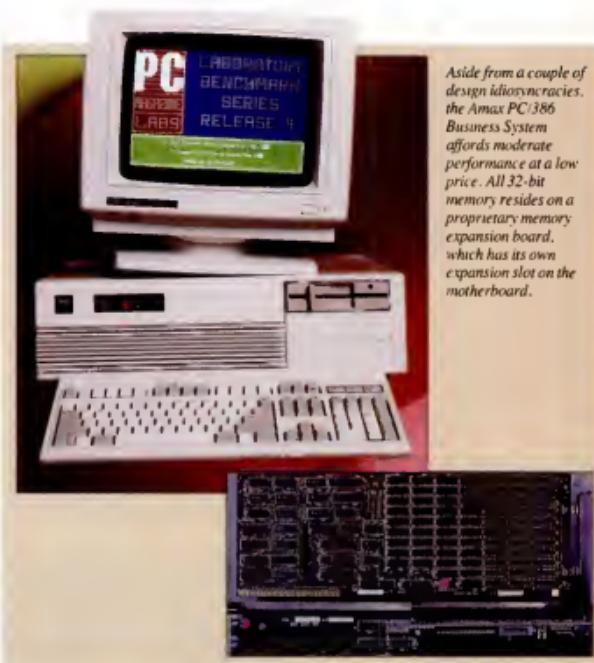
Business System

From the outside, Amax Engineering Corp.'s PC/386 Business System looks like a garden-variety AT-compatible computer, and its 20-MHz 80386 microprocessor hardly sets it off from the rest of the pack. Inside, however, is Amax's own system board, which does have a couple of design quirks. If you can live with them, you'll find the PC/386 Business System a speedy and sturdy performer.

The requisite 80386 of the PC/386 runs at your choice of four speeds—20, 10, 8, or 6 MHz. A socket is provided for an 80287 numeric coprocessor, with speed options of 4, 8, or 10 MHz (some speeds require a change of crystal). An 80387 coprocessor can be installed using an adapter board.

ON THE BOARD The Amax system board runs competently, but it misses perfection in a couple of ways. It cheats you out of an expansion slot, because one of the eight must be devoted to memory. And it lacks the automatic RAM shadowing abilities of the Chips and Technologies chip set; you must manually run an Amax program to move BIOS code into fast RAM, or else you lose the use of 384K memory.

Absent from the system board are the



VLSI chips so familiar in other computers. Its circuitry is mostly discrete chips, a design alternative that requires so much board space that memory won't fit on the AT-size system board. Instead, all RAM resides on a proprietary 32-bit plug-in memory board.

One megabyte of 80-nanosecond, 256-kilobit page-mode DRAM chips are soldered to this board, with sockets for another megabyte. Optional daughter cards can add 2MB, 4MB, or 8MB more. All RAM is parity checked. Of the first MB, only 640K is available, and that is standard DOS memory. The balance is used as "system" memory. It can be used for relocating the BIOS and EGA firmware through a program supplied with the system. Instead of expecting automatic relocation, you have to run this program every time you boot up the Amax (for instance, in your AUTOEXEC.BAT file).

With one slot devoted to RAM, seven

Aside from a couple of design idiosyncrasies, the Amax PC/386 Business System affords moderate performance at a low price. All 32-bit memory resides on a proprietary memory expansion board, which has its own expansion slot on the motherboard.

expansion slots are usable: two 8-bit and five 16-bit. One of the latter comes filled with a combined floppy/hard disk controller: in the evaluation machine, a Western Digital WD1003-WA2—an upgrade from the ST-506-interfaced controller you'll find in an AT. One 8-bit slot was filled with a Twinhead HEGA/Printer adapter, the other with a proprietary I/O card featuring a serial port, parallel port, and game port. On the same retaining bracket with the game port was a connector for a second, optional serial port, but the I/O card lacked the UART chip necessary to bring it to life.

The Amax chassis is among the sturdier ones used by compatibles, very rigid and appealingly plated with a chromelike finish on the inside. It has five half-height drive bays, two internal and three with front-panel access on the right, AT-style. The disk-mounting system uses AT-compatible rails.



FACT FILE

Amax PC/386 Business System

Amax Engineering Corp.

47315 Mission Falls Court

Fremont, CA 94539

(800) 888-AMAX

(415) 651-8886

List Price: With 1MB RAM, 1.2MB 5½-inch disk drive, \$2,565; with 40MB hard disk, EGA card and monitor, \$3,495; VGA card and monitor, \$740; 80MB hard disk, \$875; MS-DOS 3.3 and GW-BASIC, \$75. **In Short:** This well-built machine has a proprietary system board that delegates RAM to an expansion slot. The mildly cumbersome process needed to enable shadow RAM is its only major drawback.

CIRCLE 606 ON READER SERVICE CARD

■ 20-MHz 386s

STANDARD EQUIPMENT Standard equipment includes one 1.2MB 5 1/4-inch disk drive. The evaluation machine was also equipped with a Seagate ST-251 hard disk, which delivered an average access time of about 30 milliseconds and a 5-MHz transfer rate. The disk was partitioned with Ontrack Computer Systems' *Disk Manager* software, not with DOS.

The front control panel includes the standard features—cylindrical keyboard and chassis key lock, power and hard disk activity indicators—as well as a square red reset button. The rear panel follows the layout of most compatible computers, including power-in and switched power-out jacks, power-supply voltage selector (115 or 230 volts), three blanked cutouts for 25-pin D-shell connectors and two for 9-pin, the keyboard connector, and the expansion slots.

The 200-watt power supply of the PC/386 Business System was manufactured by Taiwan Liton Electronic Co. Stuck to its side, a battery holder contains the four AA cells that power the system's built-in clock/calendar and CMOS configuration memory.

The BIOS bears an Award Software copyright and includes a setup program as part of its firmware, accessible by a press of the Ctrl-Alt-Esc key combination. A

■ The Amax BIOS includes a firmware setup program, accessible by a key combination.

bank of DIP switches is used to set up the system hardware, allowing selection of color/monochrome displays and coprocessor speed.

Amax provided a Maxi-Switch keyboard that uses the 101-key IBM Advanced keyboard layout. This keyboard is noted for its soft, snapover feel and quiet operation. A Samsung CM4531 14-inch color EGA display also came with the evaluation system.

In overall performance, the PC/386

Business System slipped just ahead of the basic 20-MHz 80386s. Despite the bother of explicitly relocating the BIOS and the lack of system board memory, you probably would not regret buying the PC/386 Business System.—Winn L. Rosch

AST RESEARCH INC.

AST Premium/386

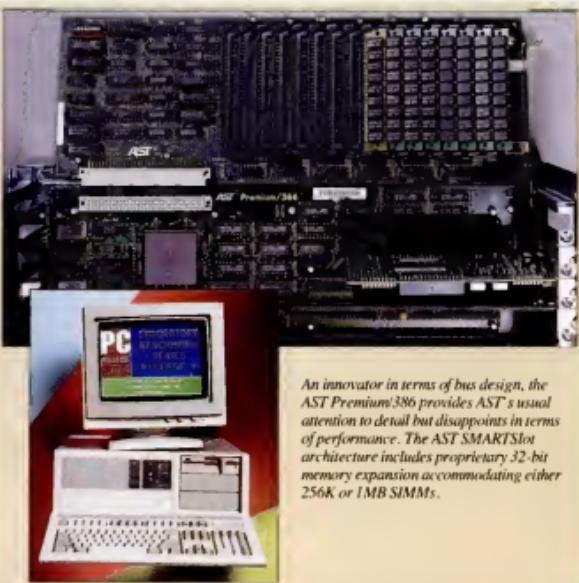
AST Research displayed a keen eye for opportunity when it challenged IBM's Micro Channel architecture (MCA) with the announcement of its SMARTSlot architecture last fall. Designed to do everything MCA can do without sacrificing compatibility with the XT/AT bus, SMARTSlot was to afford the advantages of MCA without the drawbacks.

It took AST nearly a year to ship a machine based on SMARTSlot—the 20-MHz AST Premium/386—and it turns out to be everything you'd expect from AST. Overall performance is impressive if not

spectacular, and the Premium/386 boasts the same sleek styling, armored-car construction, and attention to detail we admired in the Premium/286.

CHALLENGING A STANDARD IBM's Micro Channel architecture is important not because it's forcing all the manufacturers from here to Okinawa to redesign their add-in boards but because it offers sophisticated bus arbitration capabilities. In a nutshell, this means that add-in boards can have their own processors capable of taking over the bus to carry out specific duties. Such a processor is often called a coprocessor, or bus master. The coprocessors offload certain duties from the CPU and carry them out as the CPU crunches numbers elsewhere.

The beauty of the SMARTSlot architecture lies in its adherence to current standards. It retains the AT bus and simply adds eight additional signals—the arbitration bus. You can install any XT or AT

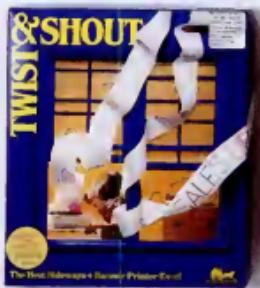


An innovator in terms of bus design, the AST Premium/386 provides AST's usual attention to detail but disappoints in terms of performance. The AST SMARTSlot architecture includes proprietary 32-bit memory expansion accommodating either 256K or 1MB SIMMs.



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SMART BUT LONELY . . . ?

AST is trying to establish a new standard with its SMARTSlot architecture bus, but other vendors aren't scrambling to manufacture compatible boards.

The AST Premium/386 is smart, tough, handsome, and built like a Sherman tank. But as Mitt Jones points out in his review, blindingly fast it isn't.

I've been using a Premium/386 for some time, and I love it. Speed isn't everything in computers; I keep telling myself . . . but in 20-MHz 386s, muscle machines from the ground up, speed counts. A lot.

So in trying to decide why I really like a computer I know isn't as fast as less-expensive rivals, I turn to the machine's second-biggest potential draw: the SMARTSlot. In the face of what is surely the biggest marketing push ever in the PC industry to establish a new standard—IBM's campaign for the PS/2s, and for the magical, mystical Micro Channel architecture (MCA) bus—AST has had the courage to attempt with the SMARTSlot to create an alternative standard.

LOTS OF SLOTS All the cards you own will fit somewhere inside the Premium/386, which is a slot maven's delight: it has two 8-bit slots; four AT-standard 16-bit slots, two of which are SMARTSlots; and one 32-bit slot.

So just what exactly can you go out and buy today to plug into that SMARTSlot?

Zip. While every add-on board vendor in the PC business will eventually offer its most important products in MCA-bus models—and several third-party PS/2 boards are already available, from

such vendors as Cumulus, STB, Quadram, Orchid, DCA, and AST itself—no one has yet announced a board for the AST SMARTSlot.

At the time of this review, AST had yet to sign up any other CPU maker for the SMARTSlot. No matter how many Premium/386s AST sells, the company is unlikely to create an installed base of SMARTSlot-equipped machines large enough to let third-party vendors profitably produce boards for that savvy slot.

Late last year, when the SMARTSlot had been shown privately—and AST had been around to other computer makers talking it up as a smart bit of self-defense in the face of IBM's MCA blitz and (subsequently abandoned) pledge never to license the MCA design to competitors—it looked briefly as if the SMARTSlot had a good chance of becoming an industrywide alternative, a true second standard.

Now that window of opportunity seems closed, forever—slammed shut both by other vendors' indifference to the idea and, more recently and finally, by IBM's decision to issue PS/2-MCA licenses. The SMARTSlot will almost certainly remain an AST exclusive. In the worst way.

Some board vendors have been talking with AST about special-purpose boards for the machine. The SMARTSlot is particularly adaptable to communications management functions, so it should be useful, for example, in building superb network servers. And multi-

master buses should be especially good with graphics-coprocessor boards.

The Advanced Disk Controller that AST is talking about building is promising. Premium/386s are already available with CDC Wren hard disks supported by ESDI controllers; mine has a 90MB Wren with an ESDI interface, producing (like the PC Labs evaluation unit) a sizzling 19-millisecond average access time. But other vendors are using Wrens and ESDI interfaces too, so such a smart controller could be an important competitive advantage.

SPEED AND SMARTS It seems likely that AST will also eventually improve performance by adding the Intel 82385 cache-controller chip and 32K or so of fast cache memory, as several other high-end 386 PC vendors have done. The combination of fast cache memory and a smart disk controller could easily be dynamite.

For now, though, buyers of the Premium/386 should know that the choice of add-in cards for the SMARTSlot is likely to be very limited; most of those cards will have AST's name on them. And even AST's willingness to support a bus found only in one model of its own line will be tested when, as seems inevitable, the company takes an IBM license to build PS/2 clones with MCA buses.

—Jim Seymour

Jim Seymour is a contributing editor of PC Magazine.

board in the Premium/386, and it should run fine, although it will not be able to take advantage of the arbitrated multimastering.

For multimastering, you'll need cards designed specifically for AST's SMARTSlot architecture. Such cards will be incompatible with IBM's MCA and

also with an unmodified AT bus, since they require eight additional signals. SMARTSlot's multimastering scheme seems to compare favorably with that of MCA, though there's no way to test the multimastering performance of the two architectures until coprocessor boards—and software that can use them—hit the mar-

ket. At the logic level, you'd be hard pressed to rate one architecture above the other. There are a few differences on the engineering level. One difference lies in the number of bus masters each system allows. In theory, MCA allows up to 15 bus masters. For all practical purposes, however, you're limited to one bus master per

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MICROPROCESSOR: Intel 8086-12
SPEED: 1MHz/2Switchable
BIOS: Award
VIDEO: EGA/VGA
DISPLAY CARD: 1 Megabyte
EXPANDABLE TO: 3 megabytes
POWER SUPPLY: HTI model 1525 220 switchable
MEMORY: 1.25 Mbytes 20-pin compatible
GRAPHICS: VGA Compatible
FLOPPY DRIVES: One 3.5" 1.2 megabyte,
one 5.25" 40 megabyte

HARD DRIVE: 12.1 megabyte, 20 milliseconds
BUILT IN INTERFACES: Parallel, -RS232C serial,
PS/2 keyboard/mouse
EXPANSION SLOTS: 3 available
MOUSE: Standard
ADDITIONAL EQUIPMENT: 5.25" C/W Drive, HeadStart
Advanced Environment, Floppy Drive,
Processor II, 3-D Graphics, ATI and
Compaq EIZZ Technical Software, Three hard
drives, 3.5" 1.2 megabyte, 20 ms, 1.2 megabyte

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■ 20-MHz 386s

slot. That translates into a maximum of nine bus masters for the PS/2 Model 80, including the CPU. SMARTSlot, on the other hand, limits you to four.

UP MEMORY LANE Once past the SMARTSlot architecture, you'll find little ground-breaking innovation in the AST Premium/386—just a good bit of no-nonsense engineering and attention to detail.

Like Compaq's Deskpro 386/20, the Premium/386 separates the 32-bit memory pathway from the system bus. This allows the memory bus to race along at 20 MHz while the system bus runs at a safe 8 MHz. System memory, upgradable to 13MB, installs in one proprietary slot.

Whereas the Deskpro 386/20 uses a 32KB static RAM cache in front of slow dynamic RAM, AST has opted for all static-column RAM (not to be confused with the faster static RAM). AST hints that Premium/386 owners may be able to upgrade their memory boards in the future. The upgrade would add a static RAM cache and Intel's 82385 cache controller to the existing board.

AST also offers three different hard disks with the Premium/386. Our evaluation unit, a Model 390, included a 90MB, 8-millisecond hard disk and a third-party ESDI controller. This setup seemed unbelievably fast at times and earned high marks on PC Labs' benchmark tests, especially when using the disk-caching utility AST includes with the system.

AST originally intended to stock all Model 390s with its ESDI SMARTSlot Advanced Disk Controller. Apparently delays in the development of that controller caused the company to ship with a Western Digital controller instead.

The Advanced Disk Controller, a feature that sounds well worth the wait, will sport its own 10-MHz processor for bus-mastering capability and 64K RAM for track buffering. An additional add-in board, AST's SMARTCache, will supply 512K RAM for a hardware cache, expandable to 4MB. The controller will be capable of driving two ESDI drives.

SLOW MOTION Considering its there-before-you-are hard disk and above-average memory performance, you'd expect overall system performance to knock you



F A C T F I L E

AST Premium/386

AST Research Inc.
2121 Alton Ave.
Irvine, CA 92714
(714) 863-1333

List Price: Model 300 with 1MB RAM, 1.2MB 5½-inch disk drive, \$4,195; Model 340 with 40MB hard disk, \$6,295; Model 390 with 2MB RAM, 90MB hard disk, \$8,495; Model 3150 with 150MB hard disk, \$9,795. EGA card and monitor, \$1,090; VGA card and monitor, \$1,140.

In Short: A sleekly styled pioneer, the AST Premium/386 sports AST's SMARTSlot architecture. It's a somewhat pricey, middle-of-the-road performer with plenty of well-engineered details.

CIRCLE 648 ON READER SERVICE CARD

over. In practice, I didn't have any serious complaints with the system's speed, but it didn't seem nearly as fast as the Deskpro 386/20 either.

That's due, at least in part, to the sluggish AST-3GPlusII EGA card included with our evaluation unit. Even with the EGA BIOS shadowed in RAM, an option that AST's utility software allows, the 3GPlusII lacked the Compaq VGA's pep. Without the shadowed BIOS, video performance was noticeably slow and more characteristic of a 286 machine than a 20-MHz screamer.

Other performance problems seem to have been the result of using the expanded memory manager and disk cache software included with the system. Running a 512K disk cache in expanded memory radically boosted hard disk throughput, but it slowed system performance in other ways. This doesn't mean that you should avoid using the cache and expanded memory manager at all costs; rather, you should try to determine whether the applications you typically use will benefit enough from the disk cache to make up for the slower all-around system performance.

NUTS AND BOLTS The Premium/386 system chassis is an inch or so narrower than an AT chassis and about as deep. The rounded corners and two-tone cover give it a stylish look, at least in comparison with

your typical desktop computer.

A hard reset button is on the front panel, above the system lock and to the left of the hard-disk-access light and three-level speed indicator. The system lock keeps intruders from using your system—but not from removing the cover and making off with your hard disk. The back panel of the chassis sports a recessed 110/220-volt switch, two 24-pin serial ports, and a parallel port as standard fare.

Inside the chassis, the system bus sports two 8-bit, XT-style slots and four 16-bit, AT-style slots. Three of the AT-style slots double as SMARTSlots, accepting an XT, AT, or SMARTSlot card. The additional contacts on the front side of the standard AT edge connectors make the SMARTSlots easy to spot. The sole, proprietary 32-bit slot accommodates all of the system's memory.

The system board provides sockets for both the 8-MHz 80287 and the 20-MHz 80387 math coprocessor. Both may be installed at once, but only one may be active at a time. You specify which coprocessor should be active through AST's setup program.

Standard equipment includes a high-capacity, 5½-inch TEAC drive. Two additional half-height drive bays under the floppy disk drive and a hidden half-height bay under the standard hard disk give you plenty of room to install additional drives. The 220-watt power supply in our evaluation unit supplied two spare power leads.

As non-IBM keyboards go, AST's 101-style keyboard rates above average. It resembles the Compaq keyboard in both styling and feel, and the computer's design allowed me to substitute my faithful, third-party 84-key keyboard with no problems.

By today's standards, the Premium/386 is a decent buy. It offers a wealth of features at a nice price and delivers impressive if not field-leading performance. But any present-day summation of the Premium/386 and its performance must also take into account the growth this system allows in the future. Like it or not, choosing among 386 machines is rapidly becoming a choice among bus standards.

Assuming that OS/2 applications catch on soon and AST comes through with its promise of intelligent add-ins, the arbitrated multimastering of the Premium/386



Benchmark Tests: 20-MHz 386-based Computers

Computer technology is currently caught between the drive for increased operating speeds and the need to retain speed compatibility with older models in order to operate speed-sensitive software. Thus, while chips are being pushed to their current 20-MHz and 25-MHz limits, bus speeds are still struggling along in the range of 8 MHz to 12 MHz.

The upshot, as reflected in the benchmark test results, is a fresh crop of 20-MHz 80386-powered machines that are markedly similar in performance. Only Dell, Everest, and Spear distinguish themselves from Compaq in terms of speed. Note, however, that Everest is running its machine at 24 MHz even though the chips are warranted by their

manufacturer just for 20-MHz operation. Such speed-ups are legitimate only when manufacturers warrant their machines' operation (Everest claims it will guarantee its machine's chips at the higher performance level). The Spear machine performed impressively on the processor tests, but because it experienced hard disk failure, no disk tests are reported.

The differences in times on the video tests reflect differences in video standards (EGA versus VGA, 16-bit versus 8-bit) as well as whether a particular system moved the video BIOS routines to system RAM as shadow RAM. The CPU 386/20, for example, scores fastest overall in the video tests because it uses a 16-bit VGA card and shadow RAM.

Processor and Memory Benchmark Tests

Performance Times
(Times given in seconds except where noted)

Disk Benchmark Tests

DOS Disk Seek (millisecounds)

	NOP	80386 Instruction Mix	Floating-Point Calculation	Conventional Memory	Extended Memory	DOS File Access (small record)	DOS File Access (large record)	BIOS Disk Seek (millisecounds)
8-MHz IBM PC AT	4.17	N/A*	35.60	0.77	11.62	72.63	19.74	29.20
Amax PC/386 Business System	1.71	3.15	12.36	0.58	N/A*	52.12	18.02	30.89
Acer 1100/20	1.70	3.30	11.92	0.52	7.67	64.94	5.20	23.81
PC Link 386/20	1.70	3.22	11.48	0.39	11.23	55.94	5.49	16.00
Whole Earth 20MHz 386 Tower	1.70	2.86	10.82	0.50	5.79	46.60	4.56	30.16
VIPC Hybrid	1.69	3.18	13.37	0.66	7.36	55.63	21.05	30.17
Dell System 310	1.68	2.71	10.27	0.37	N/A*	56.62	5.60	16.49
Everest STEP 386/20	1.68	2.65	10.03	0.35	0.36	65.25	7.63	16.16
Micro Lab 386	1.87	3.19	13.04	0.67	5.22	49.05	18.28	28.84
CPU 386/20	1.67	3.13	12.78	0.59	4.66	64.95	13.65	29.52
386/20 Northgate Power	1.67	2.85	10.82	0.46	5.77	65.62	6.49	31.49
AST Premium/386	1.85	3.35	12.70	0.61	9.12	48.24	8.12	16.82
Computer Components Heritage 386/20	1.65	3.19	13.16	0.68	21.26	62.00	5.03	16.44
AT&T 6386 WorkGroup System	1.65	3.74	12.96	0.58	9.72	50.98	4.22	17.50
Compaq Deskpro 386/20	1.65	2.91	10.50	0.40	2.87	56.78	9.34	18.10
Spear 386/20 MHz Tower System	1.65	2.75	10.00	0.36	8.40	N/A	N/A	N/A
Everest 386/20	1.39	2.58	10.43	0.50	8.34	54.49	18.08	28.71

N/A—Not applicable; the IBM PC AT is an 80286-based computer.

N/A—Not applicable; no extended memory was installed.

N/A—Not applicable; the machine experienced hard disk failure.

The NOP benchmark test is designed to measure raw clock speed and memory access time while minimizing differences in microprocessors and the effect of memory caching. This test executes almost nothing but NOP ("No Operation") machine code instructions in a big 128K loop.

The 80386 Instruction Mix benchmark test measures the time it takes to execute a selected series of processor-intensive tasks. The test program uses 80386 instruction code. These instructions are a subset of the total processor instruction set. The 80386 Instruction Mix implements a number of 32-bit operations, such as floating-point multiplication, single instructions, whereas in the 8086 and 80286 versions of the benchmark test they remain multiple instructions.

The Floating-Point Calculation test measures processor speed by looping through a series of floating-point calculations, including multiplication,

division, exponentiation, and logarithmic and trigonometric functions. The benchmark program uses the floating-point library included with Microsoft C Compiler 4.0.

The Conventional Memory benchmark test allocates 256K of conventional memory and treats it as a series of 64-byte records. Then, 16,384 random records are read into and written from this memory. The result shown is the average of the read and write times.

The Extended Memory benchmark test allocates 256K of extended memory and treats it as a series of 64-byte records. Then, 16,384 random records are read into and written from this memory. The result shown is the average of the read and write times.

The DOS File Access benchmark test measures the throughput rate of the disk being tested. In this case, throughput times are measured in terms of how long the disk takes to perform common DOS file-management functions. Five tasks—file

creation, sequential file write, sequential file read, random file write, and random file read—are timed and the results summed.

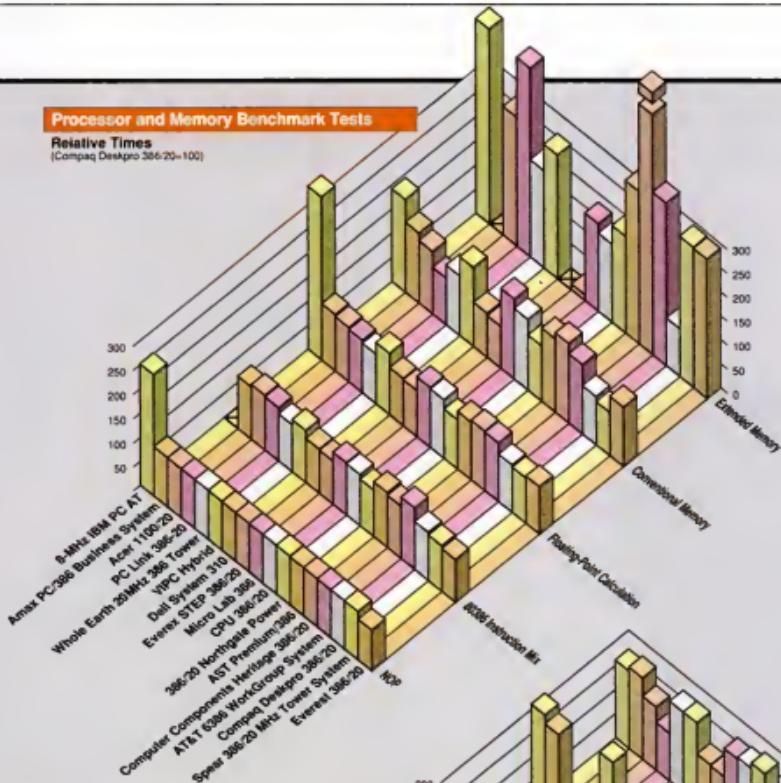
The test is carried out for two different types of files—small-record files and large-record files—that are used by common PC applications. Files created using small records are typically used by database management programs, and large records are typically used for word processing and spreadsheet files. Loading a DOS program is also simulated by the large-record test.

The BIOS Disk Seek benchmark test measures the time it takes to do a random seek using the disk's ROM BIOS. The test routine includes reading sectors over and over again and is not parallel to the manufacturer's claimed average access time. The test program performs 1,000 seeks. The average result is shown in milliseconds.

Processor and Memory Benchmark Tests

Relative Times

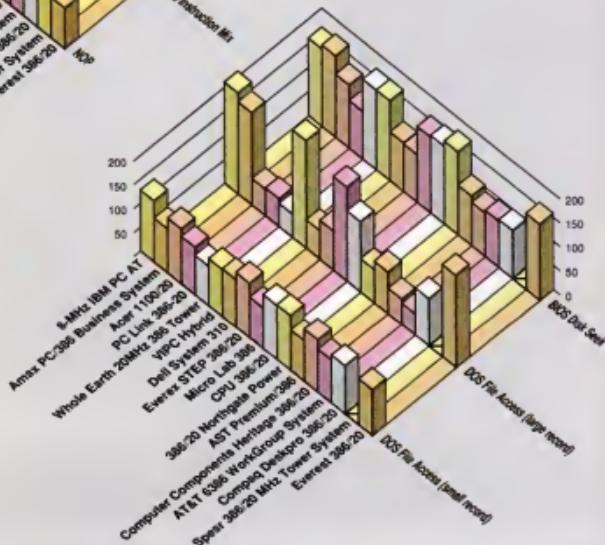
(Compaq Desklpro 386/20=100)



Disk Benchmark Tests

Relative Times

(Compaq Desklpro 386/20=100)



(continues)

This is for ev too busy to get

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Dump any random, unrelated thoughts or ideas into Agenda, and it'll help you turn that information into a stream of structured, actionable knowledge.

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File View	Category	Print	Utility	System	Quit
New	Remove	Protect	Assign	Detach	Unload
Scratches			Who	Issues	
			Forwarded product comparison articles to John	• John	• Competitive Tracking
			2. Can we get me cost of goods sold under \$10?	• Tom	• Materials
			Bob will present temporary incentives program at sales conference.	• Bob	• Bonus Dollars
			Can I have 1000000 by 12 weeks from Friday, maybe from 8-10 am, pricing -> early distribution and implications of price increase vendor for presenting and printing.	• Tom	• Distributors Version Priming
			Decision needed on research budget by John and Tom	• Jim • John	• Research

Items. Dump information in manually, import it or use our pop-up capability while in another program.

Or the thousands of factors you need to put together a new bottom line.

Agenda will not only file these random items of information for you, it'll help you arrange them any way you want.

So you can understand them better, formulate new ideas better and extract all the answers you need better.

Which means, now you can concentrate



Everyone who's any work done.

File View Item Print Utility System Quit			
Categories: Sales, Marketing, Info			
Packaging	Accept packaging bids until the end of October	• Lit	Operations
Materials	Make sure synthetic materials are reliable	• Bus	Operations
Research	Have Tom track down market research on the best cost-effective case environments	• Tom	Marketing
Distribution	Tom will have his report in by next Friday; make sure it covers pricing strategy, distribution, and shipping costs. Also, add some numbers for typesetting and priming	• Tom	Marketing
Distribution	On Tom and Bob think we need to adjust distribution mix?	• Tom	Sales

Categories. Agenda files items in all relevant categories so you can always find the information you need.

more on using and acting on your information. And less on processing it.

How does Agenda work?

First, enter your items of information

File C - AGENDA - FILES - ISSUES			
30/10/98 11:00			
Research	Decision needed on research budget by end of month. Also, meet with Jim and John	• High	DECISION
Competitive Tracking	Forward product comparison entries to John	• Low	BT00798
Bonus Points	Do Tom and Bob think we need to adjust distribution mix?	• Medium	BT00799
Distribution	Bob will present ten-point incentives program at sales conference	• Medium	BT00799
Bonus Dollars			

Views. Looking at the same information through different lenses gives you a more informed perspective.

different ways so you can pinpoint information that's important to you. Or discover new relationships you hadn't considered before. And anytime you change an item in a view, Agenda will automatically update all other categories where the item has been assigned.

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Agenda and Agenda Demo Kit require an IBM® PC or compatible, with 640K and a hard disk, DOS 2.0 or higher. Lotus and Agenda are registered trademarks of Lotus Development Corporation. IBM is a registered trademark of IBM Corporation.

■ 20-MHz 386s

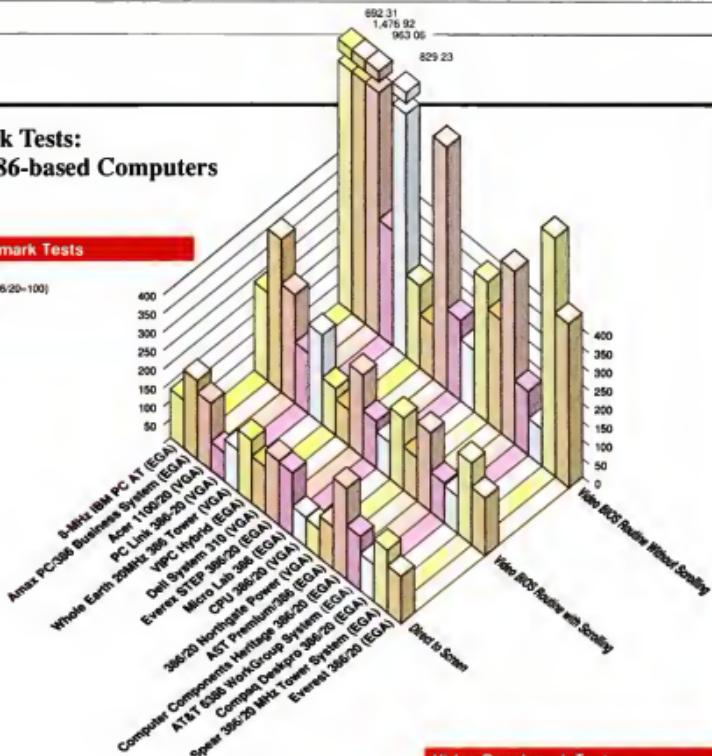


Benchmark Tests: 20-MHz 386-based Computers

Video Benchmark Tests

Relative Times

(Compaq Desklpro 386/20=100)



Video Benchmark Tests

Performance Times (Times given in seconds)

	Direct to Screen	Video BIOS Routine with Scrolling	Video BIOS Routine Without Scrolling
8-MHz IBM PC AT (EGA)	4.90	7.60	4.50
Amiga PC/386 Business System (EGA)	7.87	13.07	9.60
Acer 1100/20 (VGA)	6.70	9.29	6.26
PC Link 386/20 (VGA)	2.84	5.20	2.01
Whole Earth 20MHz 386 Tower (VGA)	4.17	7.70	5.39
VIPC Hybrid (EGA)	6.26	4.06	1.43
Dell System 310 (VGA)	4.69	3.13	0.93
Everex STEP 386/20 (EGA)	6.37	7.09	4.23
Micro Lab 386 (EGA)	6.28	4.05	1.40
CPU 386/20 (VGA)	2.93	3.13	1.07
386/20 Northgate Power (VGA)	2.84	6.21	2.45
AST Premium/386 (EGA)	4.17	3.73	1.98
Computer Components Heritage 386/20 (EGA)	9.07	6.61	3.02
AT&T 6386 WorkGroup System (EGA)	5.38	3.41	1.12
Compaq Desklpro 386/20 (EGA)	3.70	3.20	0.65
Spear 386/20 MHz Tower System (EGA)	6.21	7.03	4.17
Everest 386/20 (EGA)	4.68	4.95	2.87

The Direct to Screen benchmark test measures the bandwidth of the video adapter by writing directly to the display memory buffer. The test is performed in video mode 3. The entire screen is updated using the assembly language REP STOSW instruction with register CX equal to 2000. This is done 1,000 times, and the result shown is the total of the 1,000 trials.

The Video BIOS Routine with Scrolling benchmark test measures the speed of the BIOS Teletype routine with scrolling. The test is performed in video mode 3. The screen is cleared and 240 lines of 60 characters each (including a terminating carriage return and line feed) are written to the display through the BIOS Teletype routine. Although the first 24 lines written to the display do not involve scrolling, all the remaining lines scroll the display.

The Video BIOS Routine Without Scrolling benchmark test measures the speed of the BIOS Teletype routine without scrolling. The test is performed in video mode 3. The screen is cleared and 24 lines of 60 characters each (including a terminating carriage return and line feed) are written to the display through the BIOS Teletype routine. This is done ten times, and the result shown is the total of the ten trials.

should offer performance equaling or surpassing that of any 20-MHz machine available today. It is within this framework that AST hopes to find success with the Premium/386. The idea is that you don't lose anything by choosing the Premium today, and you may gain a lot in the future.

Not even the folks at AST can expect that the industry will wholly embrace the SMARTSlot architecture in lieu of IBM's MCA. If for no other reason, many users will follow IBM simply because they're afraid not to.

The Premium/386 stands, however, as a technologically sound alternative to the PS/2 Models 70 and 80 and their MCA. The real question is whether AST can muster the industry support to offer the wide range of coprocessor boards that will undoubtedly emerge for MCA. The answer, I fear, is no.—Mitt Jones

AT&T CORP. AT&T 6386 WorkGroup System

While nearly all other 80386-based computers seem caught in a rut following the AT design school, the AT&T 6386 WorkGroup System stands out. Its styling resembles the typical AT clone but is also refreshing; the chassis and layout are particularly noteworthy. From a functional viewpoint, though, they prove worse than the typical 80386-based PC.

Take a look at the 6386 and you'll see why AT&T may run into trouble in the personal computer marketplace. Whereas the IBM PS/2 series enjoys an elegance of design that, not incidentally, results in rock-bottom manufacturing costs, the AT&T 6386 is a complex kludge that seems to rely on the weakness of the Italian economy to keep its price low. (Like other personal computers in the AT&T lineup, the 6386 is made in Italy by Olivetti.)

The chassis is an elaborately fabricated structure that does as well as the typical clone in holding the system together. But all it yields is three half-height drive bays with front-panel access. A hard disk bay is grafted on the right—screwed on as if it were an afterthought. The extra bay adds 5 inches of unnecessary width (and cost) to the 7½-by 19-by 15½-inch chassis.



It may not be a hot performer, but the AT&T 6386 WorkGroup System can accommodate up to 48MB RAM. This computer uses the same basic chassis that has been found in previous AT&T personal computers, with the addition of a grafted-on hard disk drive bay, which frees the internal drive bays for floppy disk drives.

The drive in the bay is an excellent unit—a half-height Magnetic Peripherals (CDC) 84MB hard disk with an 18-millisecond average access time and 10-MHz transfer rate, thanks to its ESDI interface. This drive, however, could easily have gone into the three-bay stack without stretching the computer.

DRIVE MOUNTING In the main mass-storage stack, drives mount on AT-like rails of a length and width quite different from their IBM counterparts. Standard equipment includes a 5½-inch or 3½-inch high-density floppy disk drive in the top bay (a Panasonic JU-257 of the latter dimension was supplied in the evaluation system).

System controls and indicators run through the black belt at the bottom of the chassis. These include a keyboard lock

with an indicator light, a hard disk activity indicator, a hardware reset button, a volume control for the internal speaker, a push-button power switch, and a power-on indicator.

The 6386 system board comprises four parts: a main system board that lines the bottom of the chassis, accessed through a removable pan under the computer; a backplane that provides the connectors for the system's expansion slots; a short board to connect those two; and a memory board. The inefficient AT&T design does not leave any room on the big system board for RAM.

The system board itself measures more than 13 by 13 inches and is sparsely populated. Its high points are a 20-MHz 80386 and matching 80387. The system also supports the Weitek 1167 at the same speed. VLSI is notably absent from its circuitry.

■ 20-MHz 386s



FACT FILE

AT&T 6386 WorkGroup System

AT&T Corp.
1 Speedwell Ave.
Morristown, NJ 07960
(800) 247-1212

List Price: With 1MB RAM, 1.2MB 5½-inch or 1.44MB 3½-inch disk drive, *Microsoft Windows/386*, \$4,495; with 80MB hard disk, \$5,995; with 135MB hard disk, \$6,895. 80387 math coprocessor, \$1,199; EGA card and monitor, \$995; 1MB RAM upgrade, \$549; bus mouse, \$150; MS-DOS 3.2, \$95. In Short: An Olivetti-made system with an odd four-part system board and nonstandard video system, AT&T's 6386 is a very responsive machine despite its modest benchmark test performance.

CIRCLE 664 ON READER SERVICE CARD

The microprocessor does not benefit from any exotic memory technology. The memory board holds up to 16 banks of 80-nanosecond, 256K SIMMs in four banks of four. The board is also able to accommodate 1MB of SIMMs. Three such boards can be installed in a single system to bring total capacity to an impressive 48MB. Logically, the 2MB of the evaluation system was divided into 640K for DOS, 1,024K for extended, and 384K as "dedicated" memory.

OVERLOADED PERFORMANCE An unadulterated wait state drags overall system performance so far down that on the 80386 Instruction Mix benchmark test it was the slowest machine we tested. The system seems faster than that, however. The proprietary AT&T video system and quick hard disk make the 6386 respond to every command almost instantly.

Aside from the three 32-bit expansion slots for memory, which can also be used for 16- and 8-bit cards, the AT&T 6386 WorkGroup System offers two 16-bit and two 8-bit slots. In the evaluation system, three slots were filled by the factory—one 32-bit slot with memory, one 16-bit slot with a Western Digital WD1007A combined floppy/hard disk controller, and one 8-bit slot with a Paradise-based proprietary video controller.

Built into the system board circuitry are

a serial and a parallel port, located at the lower edge of the rear of the chassis. Power input and switched power output connectors from the 230-watt Alitec power supply also appear on the rear panel alongside the oversized cooling fan.

The BIOS bears an Olivetti copyright and includes an elaborate set of diagnostics that run when the system is booted. Setup software is provided with the system, along with DOS and *Microsoft Windows/386*. AT&T's version of OS/2 is an extra-cost option.

The AT&T keyboard is made by Key Tronic Corp. and proves to have the best feel of any Key Tronic keyboard to date. It follows the IBM 101-key Enhanced layout. It differs, however, in using a 9-pin D-shell connector to link with the system unit.

LAGS IN VIDEO AT&T stubbornly goes in its own direction for video. Where once the AT&T system led IBM in terms of quality, now it lags behind Big Blue, with 640- by 400-pixel resolution. For a video connector, the AT&T system uses a 25-pin female D-shell, exactly like a parallel port. In fact, you can plug the AT&T monitor into the 6386's parallel port and

■ The AT&T 6386's bullheaded refusal to follow the industry standards brands it an also-ran.

get quite a light show when you boot the computer up.

The AT&T CRT319 color monitor supplied with the system is carefully styled—a bit rounder at the edges than the current fashion dictates—and it provides a bright, sharp image measuring 10½ inches diagonally on a 12-inch tube.

Overall, the AT&T 6386 WorkGroup System is marked by good intentions—like its 48MB RAM capacity and snappy video—but its bullheaded refusal to follow

the industry standards brands it an also-ran. If you don't want to suffer the video compatibility woes, you won't want the 6386.—Winn L. Rosch

COMPUTER COMPONENTS CORP.

Computer Components Heritage 386/20

Though sold from North Carolina, the Heritage 386/20, from Computer Components Corp., originates not in the Old South but the South China Sea. This Chinese AT is chiefly a product of Taiwan's Tatung, which manufactures the system board, case, video adapter, and display. It's a well-made, competitively priced computer, though hardly innovative.

Its central processor is, of course, an 80386 running at 20 MHz. For compatibility with finicky software, it can be slowed to 8 MHz using its setup software (this requires rebooting the system). Support circuitry is chiefly built around the Chips and Technologies 80386 chip set.

The Tatung system board in the evaluation unit was socketed and equipped with an 80287 numeric coprocessor operating at 10 MHz. Computer Components has promised a new system board with provisions for a full-speed 80387; it should appear about the time this review is published.

INTERLEAVING A DRAWBACK Performance falls into the second tier, owing to the simple interleaved memory scheme. That memory is made from 80-nanosecond, 256K SIMMs. Eight sockets for these hide under the hard disk bay and are inaccessible without removing the system board from the chassis. Eight more sockets are available under the front end of the expansion slots.

Sockets must be filled in banks of four, and the hardware-setup software allows each bank to be configured to accept either 256K or 1MB SIMMs; the maximum possible system-board memory is thus 16MB. No 32-bit expansion slots are provided with the system. The first megabyte of installed memory is automatically configured with 640K for DOS, 348K for shadow RAM. The balance of system memory

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■ 20-MHz 386s



The Computer Components Heritage 386/20 is no star, but a highly configurable, solid machine. The problematic keyboard differs from the IBM Enhanced keyboard layout with repositioned Ctrl and Backslash keys, an enlarged L-shaped Enter key, an odd tactile response, and no audible feedback.

is addressed in the extended area.

The ROM bears a Phoenix Technologies copyright. A special software utility handles all system setup except for two jumpers for color/monochrome monitor selection and for enabling the coprocessor.

Two 8-bit and six 16-bit expansion slots are provided, all full-length and full AT height. Standard equipment fills both 8-bit slots—one with a Tatung Super EGA adapter (which is identical to ATI Technologies' EGA Wonder except for its firmware), the other with an I/O card yielding a serial and a parallel port.

The evaluation system also filled a 16-bit slot with a combined floppy/hard disk controller from Data Technology Corp. that links to the disk through an ESDI connection. (Other systems with ST-506-interfaced drives are also available, using different controllers.) At the other end of the cable in the evaluation system was a

Magnetic Peripherals Wren-series full-height hard disk with a formatted capacity of 150MB, a tested average access time of less than 17 milliseconds, and a 10-MHz data-transfer rate—a formidable combination.

Since Heritage 386/20 systems are essentially custom-configured, mass storage options will vary with your desires. The evaluation system included a 1.2MB 5½-inch disk drive (as drive A:) and a 1.44MB 3½-inch disk drive, both made by Toshiba; one or the other is included in the base price of the system.

FOLLOW AT'S PRACTICES The FCC Class B-certified Heritage 386/20 uses a case that follows AT practices as to size and mass-storage options, with the usual improvements in drive accommodations. All three of the right-hand, half-height drive bays can have front-panel ac-

cess, courtesy of a removable plate in the panel's bezel. The internal full-height hard disk bay also features supports for drive rails for two half-height devices. The rails themselves are unique to Tatung derivatives like the Heritage—wide, white, and nylon, they feature intrinsic L-shaped retaining brackets.

The control panel includes a cylindrical key switch for the keyboard, power and hard-disk-activity indicators, and a reset button. The rear panel offers unused cutouts for one 9-pin and one 25-pin D-shell connector, the keyboard jack, power-in and -out jacks, and the input voltage selector switch for the 230-watt Delta Electronic power supply. The CMOS clock and setup memory are powered by a 6-volt lithium battery attached to the rear panel with the strongest Velcro in the world—it pulled the chassis off rather than coming apart.

The Heritage-labeled display that accompanied the evaluation system is a Tatung CM-1495 14-inch color multisync-style display with analog and TTL inputs. On this display, the Tatung graphics adapter gives resolutions up to 800 by 600 as well as full EGA compatibility. The combination makes excellent images but does not offer any VGA compatibility.

The Tatung keyboard is the least desirable part of the Heritage 386/20 system. The odd half-breed key arrangement is un-



FACT FILE

Computer Components Heritage 386/20

Computer Components Corp.

2700 Gateway Cr.

Morrisville, NC 27560

(800) 843-7012

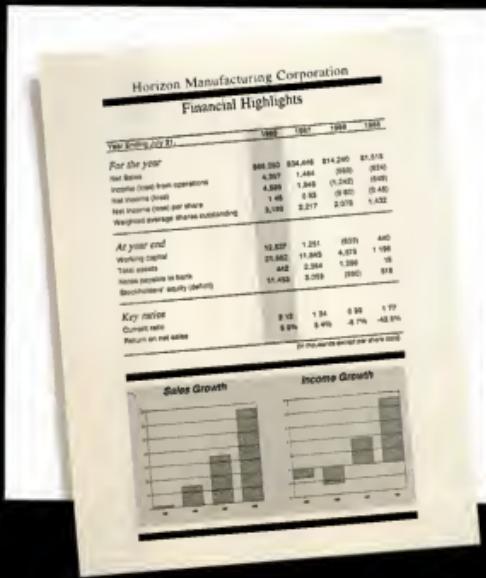
(919) 469-9301

List Price: With 2MB RAM, 1.2MB 5½-inch or 1.44MB 3½-inch disk drive, MS-DOS 3.3, GW-BASIC, \$2,999; with 40MB hard disk, monochrome monitor, \$3,549; with 80MB hard disk, EGA card and monitor, \$4,245; with 150MB hard disk, 2 floppy disk drives, 80287 coprocessor, \$6,927.

In Short: Blessed by a good display and cursed by its keyboard, this all-Tatung computer is highly custom-configurable. The Heritage 386/20 is fairly priced but proved to be an inconsistent performer.

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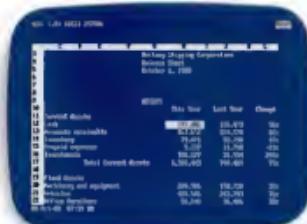
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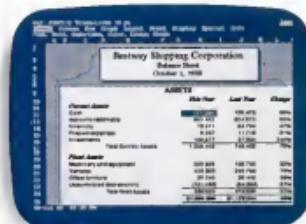
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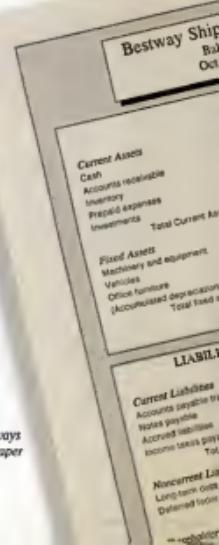
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■ 20-MHz 386s

like any IBM design and mixes several layout ideas—top-row function keys, twin Ctrl and Alt keys flanking the Spacebar, an odd Macro key at bottom left, and a mysteriously migrated Backslash. Even worse is the keyboard's feel—a funny, indecisive bounciness with odd tactile response and no audible feedback. You'll probably want to throw this keyboard out and get something more comfortable in its place.

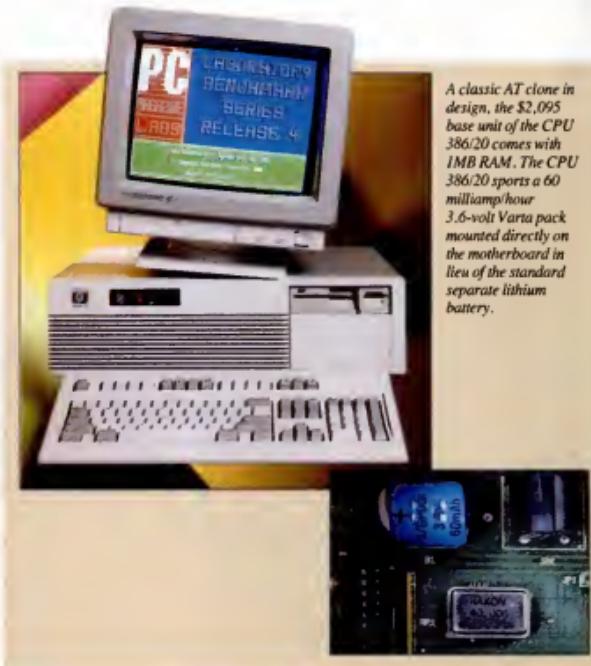
During evaluation, the Heritage 386/20 demonstrated odd hard-disk errors that persisted even after recopying files. Shortly after the completion of testing, it failed completely. The trouble is probably confined to the evaluation unit. The Heritage 386/20 system itself seems a sound and fair competitor in the increasingly crowded 20-MHz marketplace.—Winn L. Rosch

COMPUTER PRODUCTS UNITED

CPU 386/20

Little distinguishes the CPU 386/20, of Computer Products United, from the multitude of 80386-based AT-compatible computers. The machine is physically identical to a dozen machines you might buy via mail order, and it offers you many of the same options. Its performance may be a little better, but its construction is just a little worse.

It has a very familiar story. Its 20-MHz 80386 microprocessor can be slowed to 8 MHz by pressing Ctrl, Alt, and the minus



sign even from within applications. Sockets are available to add either a full-speed 80387 or an 80287 (speed not specified) to expedite floating-point operations.

The CPU 386/20 takes advantage of the now-classic tricks in speeding up its RAM. With 1MB of SIMMs installed, memory operates in page mode; add a second megabyte, and it becomes interleaved two ways. The proprietary 32-bit slot supports the same memory architecture.

The system BIOS bears an American Megatrends copyright and includes setup and diagnostics as part of its code. Hardware setup also requires jumper settings to match microprocessor and coprocessor speeds as well as monitor type.

System memory is logically split with 640K allocated for DOS, 384K for shadow RAM, and the balance for the 80386's extended addressing range.

DESIGN ENHANCEMENTS The physical aspects of the CPU 386/20 are

classic AT-compatible style, and include the usual enhancements. A square red reset button joins the now-customary cylindrical keyboard-and-case lock and the power and hard-disk-activity indicators that are located on the front control panel. Five capped cutouts for D-shell connectors (three 25-pin, two 9-pin) are located on the rear panel adjacent to the keyboard connector.

Five half-height drive bays occupy the right front of the chassis: two internal, three with front-panel access. The evaluation machine filled one of the latter with a 1.2MB, 5½-inch TEAC floppy disk drive. A Seagate ST-251 40MB half-height hard disk was hidden inside. The latter delivered true 30-millisecond average access time through its 5-MHz ST-506 interface. Computer Products United included Disk Manager, from Ontrack Computer Systems, with the evaluation unit. The power supply offers 204½ watts of juice and provides a switched outlet for a display. Its in-



FACT FILE

CPU 386/20
Computer Products United
12803 Schabarum Ave.
Irvine, CA 92106
(800) 824-2936
(818) 338-5959

List Price: With 1MB RAM, 1.2MB 5½-inch disk drive, \$2,095; with 40MB hard disk, \$2,790. 1MB RAM upgrade, \$495; 80MB hard disk, \$630; VGA card and monitor, \$845; 80387 math coprocessor, \$595. **In Short:** Although poorly constructed, the CPU 386/20 is a solid performer at a low price. It's an unremarkable machine whose mass storage and memory possibilities closely follow those of an AT clone.

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8.0	7.5	6.5

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(October 11, 1986)



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■ 20-MHz 386s

put voltage is selectable between 110 and 220 volts using a rear-panel slide switch. To power the CMOS clock and configuration memory inside the Chips and Technologies chip set that the CPU 386/20 is built around, a rechargeable nickel-cadmium battery is soldered to the system board.

The eight expansion slots include six equipped with an 8-MHz, 16-bit AT bus, and two 8-bit slots. One of the 16-bit slots is also graced by the 32-bit memory expansion connector.

Stealing one 16-bit slot and the retaining bracket of another, a proprietary I/O card offers two serial ports, a parallel port, and a game port. On our evaluation unit, an NCL floppy/hard disk drive controller and a Video Seven 16-bit VGA card filled two more 16-bit slots. The latter, coupled with shadow RAM, yielded exceptional on-screen performance.

BOUNCY KEYBOARD FEEL. The keyboard, made by Fujitsu and patterned exactly after the IBM Enhanced design, was at best unremarkable. Its bouncy, rubbery, over-center feel is usable but hardly lovable. The evaluation system was also accompanied by a NEC Multisync II display—nearly the industry standard.

Although the performance of the CPU 386/20 is good, its workmanship is somewhat below par. The system board was improperly installed in the case so that it noticeably bowed. The system arrived without having its disk controller connected to the drives (although the system was already formatted and ready to go). It also lacked an FCC certification sticker.

In operation, however, the CPU 386/20 performed flawlessly. If you've had some experience with DOS and AT compatibles, you may find the CPU 386/20 a good choice at the right price.—Winn L. Rosch

DELL COMPUTER CORP.

Dell System 310

The System 310, the flagship of the Dell Computer Corp. flotilla, has a perfectly conventional exterior design. It looks as docile as a lamb, a typical first-generation AT clone—the same big square box, the same AT-derived styling. Once the DOS prompt appears, however, the sheep's clothing falls by the wayside as the System



310 races ahead. It's one of the fastest 20-MHz 80386-based computers ever tested by PC Labs.

To get up to speed, the Dell System 310 uses a double strategy. A 32K cache of 35-nanosecond static memory cuts wait states to a minimum. When the cache misses, the high-speed, 60-ns. interleaved main memory takes up the slack, trimming the wait to the barest minimum.

The system board provides sockets for eight SIMMs for main memory, but only four were filled with 256K modules in the evaluation unit, the system's standard equipment. Of that basic megabyte, 640K is devoted to DOS and the balance is used for shadow RAM. When more memory is present, it resides in the extended addressing area.

Beyond 2MB, expansion requires either 1MB SIMMs (pushing system board capacity to 8MB) or a proprietary 32-bit expansion board that uses a special system-board socket at the end of slot zero, an

erstwhile 8-bit slot. Another 8-bit slot and six 16-bit slots complete the System 310 quota.

In the evaluation system, only one 16-bit slot was filled—with a Western Digital WD1007 combined floppy/hard disk controller—and one 8-bit slot was filled with a Paradise VGA adapter. All slots are full length and full height.

Lessening the need for stuffing those slots are the three ports engineered into the system board circuitry, two serial and one parallel, all lined up at the bottom rear of the chassis.

The system board relies on the Chips and Technologies 80386 chip set, all parts rated at 20 MHz, like the microprocessor itself. A socket is provided for an optional numeric coprocessor, which can be either an Intel 80387 or a Weitek 1167 rated at 20 MHz. The system also operates at reduced speeds of 8 and 4.77 MHz.

As with the rest of the Dell computer line, the BIOS of choice hails from Phoe-

■ 20-MHz 386s



EDITOR'S
CHOICE

FACT FILE

Dell System 310

Dell Computer Corp.
9505 Arboreum Blvd.
Austin, TX 78759-7299
(800) 426-5159
(512) 338-4400

List Price: With 1MB RAM, 1.2MB 5½-inch or 1.44MB 3½-inch floppy disk drive, \$2,999; with 40MB hard disk, monochrome monitor, \$3,899; with 90MB hard disk, VGA card and monochrome monitor, \$4,899; with 90MB hard disk VGA card and Color Plus monitor, \$5,199. Additional floppy disk drive, \$200.

In Short: An exceptional machine that leaves all but a few 20-MHz 386s in the dust on benchmark tests. Excellent workmanship at a moderate price makes the Dell System 310 a top choice.

CIRCLE 661 ON READER SERVICE CARD

nix Technologies, affording full DOS and OS/2 compatibility. For the System 310, Dell supplies its own version of OS/2, Version 1.0, written in 16-bit code. Setup requires running a software procedure.

SUPERIOR CONSTRUCTION Physical construction of the 310 rates as superior to that of most AT derivatives. The front panel is distinguished by a beveled notch at the upper left, where you'll find a keyboard-and-case key lock (which uses flat keys) as well as power and hard-disk-activity indicators. Numerous internal appendages help ensure the integrity of shielding afforded by the steel cover and chassis, earning the System 310 an FCC Class B certification.

For installing mass storage, the 310 includes an internal bay with space for two half-height or one full-height hard disk and, on the right, three half-height bays with front-panel access. Drives mount using heavyweight aluminum rails, larger than those of their IBM counterparts, and are secured by screwing the rails into the sides of the bay rather than using brackets at the front of the chassis.

One nice touch is the System 310 Component Identification, a large label pasted atop the right-hand drive bay. This label identifies all the principal internal components and cable connectors so that you won't have to refer to the manual (if you

can even remember where you put it) when you want to make changes inside the computer.

STANDARD SETUP One 1.2MB 5½-inch or 1.44MB 3½-inch floppy disk drive comes as standard equipment. The evaluation system had an Epson SD-680L 5½-inch drive and a Sony 3½-inch drive. The hard disk was a Magnetic Peripherals half-height unit with about 90MB of formatted capacity. A truly high-speed performer, it delivered an 18-millisecond average access time at a 10-MHz data transfer rate, courtesy of its ESDI host connection. Other Dell hard disk choices include 40-, 150-, and 322MB models.

The 200-watt Astec power supply operates on either 115 or 230 volts, selectable using a rear-panel slide switch. Five DC connectors for disk drives and a switched outlet for a display (but not the display itself) are part of its standard endowment.

Dell includes a Key Tronic keyboard that follows the 101-key IBM Enhanced design. This American keyboard's feel made it seem vastly superior to the Key Tronic product of Oriental origin supplied with the VIPC Hybrid. Although lacking audible feedback, it yielded a snappy action with a relatively soft touch.

On its front bezel, the display supplied

■ **A truly high-speed performer, the Dell's hard disk delivered an 18-millisecond average access time at a 10-MHz data transfer rate.**

with the evaluation system bore the PC's Limited VGA Color Plus moniker ("PC's Limited" being Dell's former principal trade name). A Dell label adorned the rear. The display is somewhat bulky for its size (13½ inches of screen visible) but includes a built-in tilt-and-swivel base. Controls are minimal (brightness, contrast, and power

in the front, with screwdriver-adjustable height controls for 350-, 400-, and 480-line modes in the rear), and power and signal cables are permanently attached. The image, actually, is very good—bright, saturated, and full of contrast.

Short of treading into 25-MHz territory and fronting the hefty costs involved, the Dell System 310 is one of the fastest computers you can buy. It's also one of the best-made.—Winn L. Rosch

EVEREST COMPUTER CORP. **Everest 386/20**

The engineers at Everest Computer Corp. have discovered the secret in making their Everest 386/20 one of the fastest 20-MHz 80386-based PCs—they simply run its microprocessor at 24 MHz. Ignore the fact that all of its major components are courting disaster by operating about 20 percent beyond their maximum ratings, and you'll find that the Everest 386/20 is a compelling small-footprint machine that does a good job delivering 80386 power.

Look at its performance on our 80386 Instruction Mix benchmark test, and you'll see that the Everest 386/20 is one of the speed leaders. Peer inside and it will seem still more amazing. On the system board, you'll see no high-speed cache controller or superquick static RAM chips. No special page-mode RAM. At best, it features moderately fast memory (70-nanosecond) dynamic RAM chips arranged with a two-way interleaving. Memory is divided up with 640K for DOS, 384K shadow RAM, and the balance extended.

CRYSTAL SECRET The secret to its success is a small aluminum can emblazoned with the rating 48.00 MHz. (You can divide this crystal's rating in half to calculate the microprocessor's operating speed.) The bulk of the system's components, primarily the Chips and Technologies 386 chip set and the 80386 microprocessor, are all rated by their manufacturers for operation at 20 MHz, so it is Everest that guarantees performance at the 24-MHz level. A socket is available for an 80287 numeric coprocessor, although its required speed rating is not specified in the documentation. The ROM bears an

(continued)

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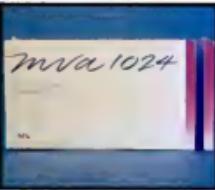


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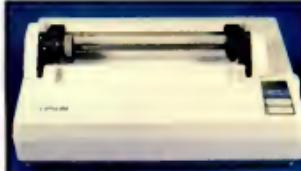
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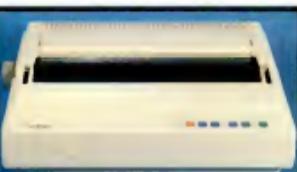
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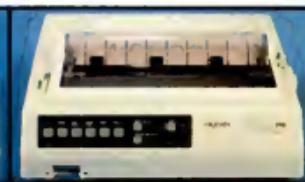
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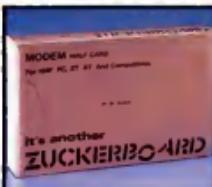
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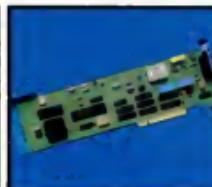
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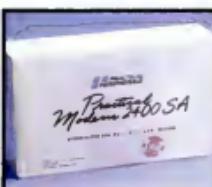
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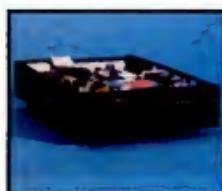
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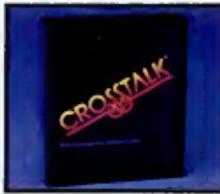
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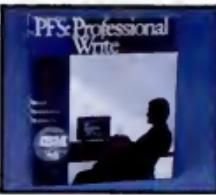
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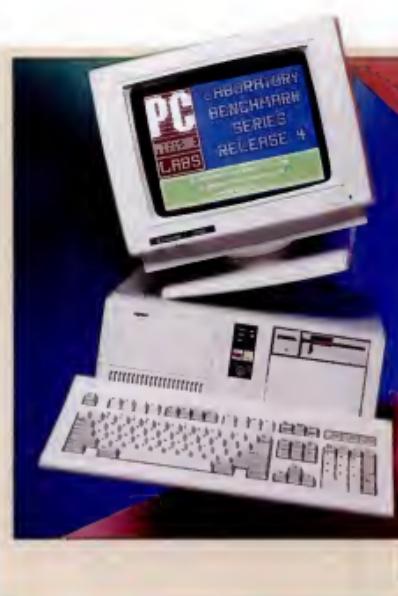
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■ 20-MHz 386s



The Everest 386/20 should really be called the Everest 386/24: it utilizes a 48-MHz crystal that drives the system's 20-MHz components at 24 MHz. This small-footprint computer supplies 2MB RAM, a 40MB hard disk, and an EGA display for \$4,185.



AMI copyright, including both a setup program and diagnostics in its firmware.

The system board is actually more diminutive than the computer itself. Designed for an XT case, it allocates space for eight SIP sockets for memory modules, which the manufacturer says have yet to be

developed. Instead, system RAM is stuffed into the Everest 386/20's sole 32/16-bit expansion slot. The board provides space for 72 256-kilobit DRAM chips, rated at 70 nanoseconds in the evaluation system.

Half of the eight slots use an 8-bit interface, the others 16-bit. All are full-length and full AT height, despite the smaller chassis. The 32-bit memory board takes over one 16-bit slot. This board also provides two serial ports and two parallel ports, one of each fitting on a retaining bracket at the back of another slot. An Everex EGA adapter steals an 8-bit slot, and an unmarked Taiwanese floppy/hard disk controller based on Western Digital chips takes another 16-bit slot.

HOW TO BE SMALL. The key to the smaller case is a missing internal hard disk bay. Only three half-height drive bays are available, all of which can have front-panel access. In the evaluation system, one was filled with a Fujitsu 1.2MB 5½-inch floppy disk drive, another with a Seagate ST-251 half-height hard disk. The latter is

operated through a standard ST-506 interface and achieved a 29-millisecond average access time in testing.

The power supply, marked Seasonic, is rated at 200 watts. The Everest 386/20 documentation claims that this compact unit has a built-in UPS—or "unbreakable power system [sic]." If it does, it affords you at most several milliseconds of protection, according to our tests. The "preliminary" instruction pamphlet takes even greater liberties with the English language than it does with the truth, although it might serve well as a primer in pidgin.

Both power input and switched power output connectors are available on the rear of the power supply, as is an input voltage selector. A battery holder glued to the side of the power supply accommodates four AA cells to power the CMOS clock and setup memory. The controls are on a vertical panel near the center of the machine's front bezel, with three indicators (power, hard-disk activity, and turbo), two unmarked push-button switches (which control turbo mode and reset), and a cylindrical key lock for the keyboard.

The 6- by 17½- by 16¼-inch case resembles a cut-down AT. According to the documentation, the assembly has been tested for an FCC Class A rating. The machine bears no indication of whether it actually passed the test, however. Internal workmanship is mediocre at best.

The keyboard supplied with the Everest 386/20 was manufactured by Chicony Electronics Co. and follows the IBM En-

■ The Everest 386/20's system board is actually more diminutive than the computer itself.

hanced 101-key layout. It rates OK, neither exemplary nor irritating, with a plain linear feel and no audible feedback. (Note that its action is entirely different from the Chicony keyboard that accompanied Pan-United's Micro Lab 386.)

Were the Everest 386/20 operated with-



FACT FILE

Everest 386/20

Everest Computer Corp.
(A division of CMP Enterprise Co., Ltd.)

1153 Tasman Dr.
Sunnyvale, CA 94089
(408) 734-2604

List Price: With 2MB RAM, 1.2MB 5½-inch disk drive, MS-DOS 3.3, \$2,995; with 40MB hard disk, EGA card and monitor, \$4,185.

In Short: The 386/20 is an inexpensive small-footprint 386 that operates its microprocessor and support circuitry beyond their ratings to achieve superfast performance. It suffers from mediocre workmanship.

CIRCLE 600 ON READER SERVICE CARD

■ 20-MHz 386s

in the ratings of its components, it would be just another clone, with unremarkable performance and quality. Overlook this machine's shortcomings only if its 24-MHz speed is the determining factor for your purchase decision.—Winn L. Rosch

EVEREX COMPUTER SYSTEMS DIVISION

Everex STEP 386/20

When Everex made the big leap from component supplier to computer maker, it did so in a big way, leapfrogging ahead of all but the toughest competition. Using a unique scalable cache, the company's first computer, the STEP 386/20, has the power to outrun everything else that boasts a 20-MHz 80386. It's one of the fastest machines in this high-speed 20-MHz group. And it leaves but one question: What does the company do for an encore?

The design of the STEP 386/20 is straightforward; the CPU is coupled to the special speedy cache, which comprises 64K or 128K of 25-nanosecond static RAM, and one or two banks of four 256K SIMMs rated at 150 nanoseconds for main memory. The cache grows to a massive 256K should you slide an Everex memory expansion card into the system's one proprietary 32-bit slot.

The STEP 386/20 can also be configured for 1MB SIMMs, increasing system board capacity to 8MB. The cache size increases with the number of SIMMs (not megabytes) installed, so the 8MB machine would still have a 128K cache. This cache works for both memory reads and writes, so it eliminates most of the wait states other cached systems may impose when writing to memory.

Of the 2MB in the evaluation machine, 640K was devoted to DOS and 1,024K to extended memory. The missing 384K is used for shadow RAM, copying slow ROM routines into fast RAM.

If you need more power, you can pop a 20-MHz 80387 math coprocessor into a waiting socket, providing your fingers are flexible enough to reach where it's hidden under the hard disk bay. If you want less power, you can slow the STEP 386/20 down to either 10 or 6.67 MHz. Unlike other machines that merely add more wait states to slow down their microprocessors,



The Everex STEP 386/20's unique scalable cache boosts performance above all but a few 386 competitors. Its recessed control panel provides diagnostic information via an LCD as well as switches to change processor speed, lock the keyboard, turn the speaker off, and reset the computer.



the STEP 386/20 actually reduces the speed for the system clock by dividing it by two or three.

Both the keyboard and ROM BIOS bear an AMI copyright. System setup and diagnostics are built in, and DOS 3.3 is included in the basic price.

IMPROVES ON DESIGN Although the STEP 386/20 comes from the AT design school—one internal full-height hard disk bay and three half-height bays, all of which (including the internal bay) have front-panel access—the styling resembles an overgrown stereo cassette recorder. At the left of the front panel is a smoky plastic door with a control panel lurking behind it. Switches here allow you to select the system speed, turn the speaker on and off, reset the system, and lock the keyboard (but not prevent physical access inside).

The power, hard-disk-activity, and speed indicators are topped off by a yellow eight-digit alphanumeric diagnostic display. Besides error and BIOS messages, it identifies the logged disk drive and indicates the current position of the head.

The 6 1/2- by 21 1/4- by 17-inch case is all steel except for the plastic front panel, good enough to earn an FCC Class B rating. Its rear panel and internal layout are entirely conventional, with expansion slots at left rear, keyboard connector near the center of the rear panel, and the 200-watt Taiwan Liton Electronic Co. power supply.



F A C T F I L E

Everex STEP 386/20

Everex Computer Systems Division

48431 Milpitas Dr.

Fremont, CA 94538

(800) 356-4283

(415) 683-2246

List Price: With 1MB RAM, 1.2MB 5 1/4-inch disk drive, MS-DOS 3.3, \$4,599; with 2MB RAM, 80MB hard disk, EGA card and monitor, \$6,503. Weitek 1167 math co-processor, \$995.

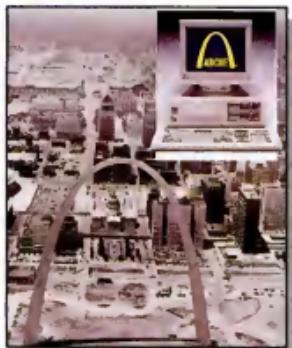
In Short: The Everex STEP 386/20 uses its unique scalable cache to zoom ahead of most 20-MHz 386 competitors. It's a well-constructed AT-style computer with no disappointing features.

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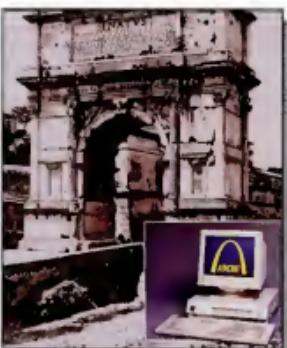
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CIRCLE 111 ON READER SERVICE CARD

■ 20-MHz 386s

at right rear. The dual-voltage power supply (115 or 230 volts, selected by a rear-panel slide switch) includes four power connectors for disk or tape drives as well as a switched outlet for a monitor.

One half-height, high-density 5½-inch floppy disk is standard equipment—a TEAC FD-55GFR in the evaluation machine. An optional Priam Model 519 full-height hard disk filled the internal bay. Rated at 28 milliseconds average access time, the Priam disk uses a 5-MHz data transfer rate ST-506 interface. Drives mount AT-style on rails. The STEP 386/20 rails are stamped steel, however, and feature integral retaining brackets.

Of the eight full-length, AT-height expansion slots, six use a 16-bit bus, two an 8-bit bus—all operating at 6.77 MHz. One 8-bit slot is also equipped with a proprietary 32-bit expansion bus, which operates at microprocessor speed (20 MHz). One 8-bit slot is filled with an Everex serial and parallel port card. A 16-bit slot holds an Everex EGA-style display adapter (which actually uses an 8-bit interface); another holds a Scientific Micro Systems combined floppy/hard disk controller.

The keyboard, a Maxi-Switch model ME-101, features the IBM Enhanced layout with 101 keys. Its rubber-dome mechanism results in quiet operation and good

■ The clever electronic design of the STEP 386/20 puts it ahead of its more expensive competition.

tactile feedback.

The EverVision EGA display that accompanied the STEP 386/20 includes a tilt-and-swivel base and a minimum of controls. Its 12½-inch diagonal screen uses a dark matrix and is antiglare treated. Image quality proved bright and sharp.

The clever electronic design of the STEP 386/20 puts it ahead of its more expensive competition. Its design and performance are good incentives for giving this familiar name a try.—Winn L. Rosch

NORTHGATE COMPUTER SYSTEMS

386/20 Northgate Power

Northgate Computer Systems' 386/20 Northgate Power is a sturdy computer that's near the top of the list as far as performance is concerned. Otherwise an excellent computer, the system suffers from potentially slower performance when memory is expanded beyond 4MB, and also from the lack of a 32-bit slot.

The lively performance of the 80386 processor running at its rated 20 MHz gains much from a 64-kilobit memory cache composed of 25-nanosecond static RAM chips. The cache puts the 386/20 Northgate Power among the leaders at its speed level, placing it just a step back from the Everex STEP 386/20 and Dell System 310.

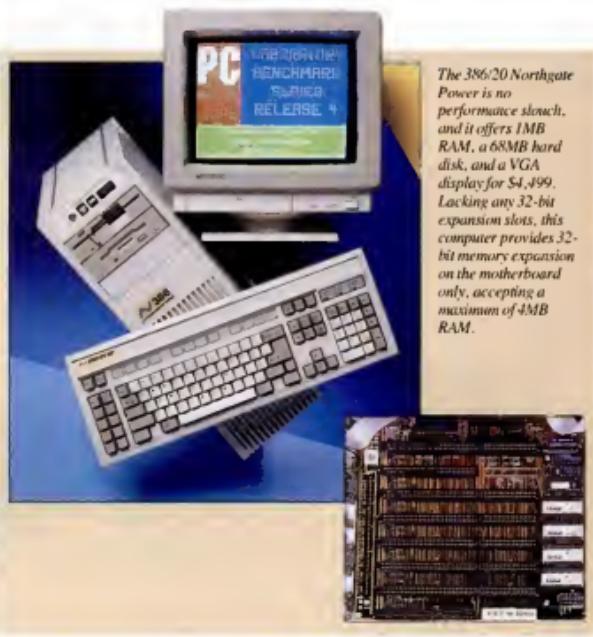
If you need more performance, you can add in an 80387 numeric coprocessor. If

you want to accommodate finicky software, you can slow the system down to 8 MHz from the keyboard.

The Northgate system board can hold exactly 36 120-nanosecond dynamic RAM chips. While the standard configuration puts 256-kilobit chips into these holes, an extra \$1,360 will fill the board to its maximum 4MB capacity with 1-megabit chips. No slots are provided for 32-bit expansion, but the system will accommodate up to 16MB, with the balance coming from standard 16-bit expansion cards.

The 640K of memory is given over to DOS. The entire balance is addressed as extended memory. The 386/20 Northgate Power neither imposes overhead nor wastes a byte. It does not, however, permit shadowing of the BIOS routines in ROM.

MEMORY CLAIMS According to Northgate, the cache minimizes any speed penalty arising from using narrow bus



The 386/20 Northgate Power is no performance slouch, and it offers 1MB RAM, a 68MB hard disk, and a VGA display for \$4,499. Lacking any 32-bit expansion slots, this computer provides 32-bit memory expansion on the motherboard only, accepting a maximum of 4MB RAM.

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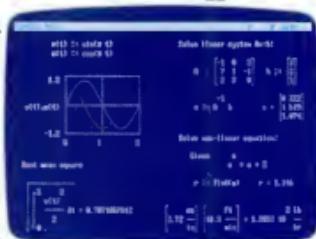
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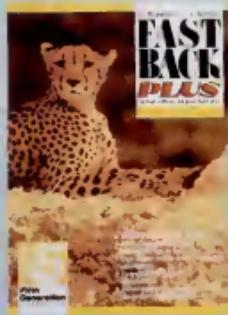
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■ 20-MHz 386s

memory—generally true—which hypothetically saves you from needing to buy more-expensive 32-bit memory. The second claim does not consider that both 32-bit and 16-bit memories of the same capacity use the same number of the same kind of chips at the same price. Moreover, the Dell System 310 shows the advantage of having fast underlying memory even with a smaller cache.

The system board bears mostly discrete integrated circuits; the big VLSI chips that other machines use are notably absent. The BIOS bears an AMI copyright and big Mylex labels, hinting at the manufacturer of the system board (it's a Mylex MB386). Built into its firmware are the system setup program and diagnostics. In addition, a bank of DIP switches and a long row of jumpers are used for hardware configuration.

Six AT-compatible 16-bit and two 8-bit slots constitute the 386/20 Northgate Power's expansion limit. In the evaluation system, one 8-bit slot was filled with an I/O card that offered one serial and one parallel port. A 16-bit interfaced VGA card based on Video Seven's chips and an Adaptec 2372A hard disk controller occupied 16-bit slots.

As tower-style computers go, the 386/20 Northgate Power is reasonably compact, measuring 21 by 7 by 16½ inches.

PC FACT FILE

386/20 Northgate Power

Northgate Computer Systems
13895 Industrial Park Blvd., #110
Plymouth, MN 55441
(612) 553-0111

List Price: With 1MB RAM, 68MB hard disk, 1.2MB 5½-inch and 1.44MB 3½-inch disk drives, 14-inch amber monochrome monitor, V/Oյw disk optimizer, MS-DOS 3.3, disk cache, \$4,199; with VGA card and 14-inch VGA monitor, \$4,499.

In Short: Compact (for a tower) and well made, this respectable performer lacks a 32-bit slot. The 386/20 Northgate Power sports good workmanship in spite of its Class A FCC certification.

CIRCLE 386 ON READER SERVICE CARD

es. For the most part, it is laid out like an ordinary AT compatible, but its three half-height drive bays run perpendicular to the long axis of the machine. The internal full-height hard disk bay (usable as twin half-heights) parallels the main axis. Drives mount using proprietary narrow steel rails.

The case is a true heavyweight, made from pale gray/beige steel, with more steel reinforcing the inside of the chassis. Notwithstanding the all-metal case, the 386/20 Northgate Power earned only Class A FCC

certification. Workmanship, however, is very good overall. The case's biggest shortcoming is that it makes extra work out of changing mass storage options. The front bezel must be removed first, requiring you to tangle with several hard-to-reach screws.

Standing on its own two feet, the 386/20 Northgate Power has its expansion slots at the bottom, with its keyboard connector just above them, five connector cutouts (three 25-pin, two 9-pin) above it, and the power supply crowning them all. Both input and switched power output connectors are available, as well as a 115/230-volt input selector.

The power switch is part of the control panel, which caps the front panel of the tower. Included here are a cylindrical keyboard key lock, a turbo switch, and a reset switch. A power indicator is part of the on/off switch; turbo and drive/activity indicators are part of the turbo switch.

The power supply, made by Skynet Electronic Co., is rated at 192 watts and offers four drive connectors. Reserve power for the built-in clock and CMOS setup memory comes from an on-board rechargeable nickel-cadmium battery.

Included with the base price of the system are what Northgate calls "any format" 5½- and 3½-inch floppy disk drives, capable of reading, writing, and format-

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■ 20-MHz 386s

ting both double- and high-density diskettes compatible with all other floppy disk drives.

STORAGE OPTIONS For fast mass storage, the evaluation system was equipped with a Miniscribe 1060 hard disk, its 40MB nominal capacity enhanced to 68MB, courtesy of its RLL controller. The drive operates with a 1:1 interleave and delivers an average access time of about 32 milliseconds. The RLL interface yields a 7.5-MHz data transfer rate. Other drive options, including ESDI and SCSI units, are also available.

The system is blessed with Northgate's own Omni Key 102 keyboard. The 102-key layout is proprietary, but it combines many of the best features of IBM's designs, putting function keys back on the left and moving Ctrl, Caps Lock, and Esc where they belong, while maintaining a separate cursor pad in addition to the combined cursor/numeric keypad. Best of all is the feel—it's as close to the positive snap-action of IBM's keyboards as any compatible comes. It also gives off an IBM-like key click.

The monitor choice was equally inspired, a NEC Multisync II. The 16-bit VGA board and sharp display gave bright, colorful, and quick results. Only by adding

■ The 386/20 Northgate Power is blessed with Northgate's own Omni Key 102 keyboard.

the last bit of VGA compatibility and shadowing the display BIOS could the system be improved.

Northgate includes both DOS 3.3 and BASIC with the system. In addition, it provides a proprietary disk-caching program and Golden Bow Systems' VOpz disk optimization software.

In PC Labs benchmark tests, the 386/20 Northgate Power generally held its own against the Compaq Deskpro 386/20. Purists may long for shadow RAM and greater

32-bit expansion, but the system should work well enough for DOS denizens as it is.—Winn L. Rosch

PAN-UNITED CORP. Micro Lab 386

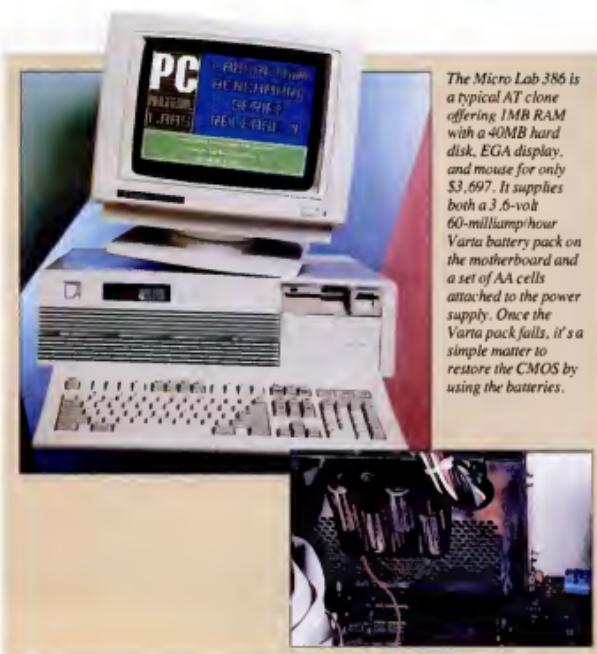
The Micro Lab 386 from Pan-United Corp. shows how a small manufacturer with an otherwise good product can fall to its knees when it comes to claims and documentation. This machine is a thoroughly competent 20-MHz 80386-based AT compatible that delivers good performance. It's well made and includes enough standard features to make it a tempting buy. But its misleading documentation and implementation shortcuts kick it out of contention as a serious 80386 competitor.

The foundation of the Micro Lab 386 is, as is usually the case with smaller manufacturers, a photocopy of IBM's AT de-

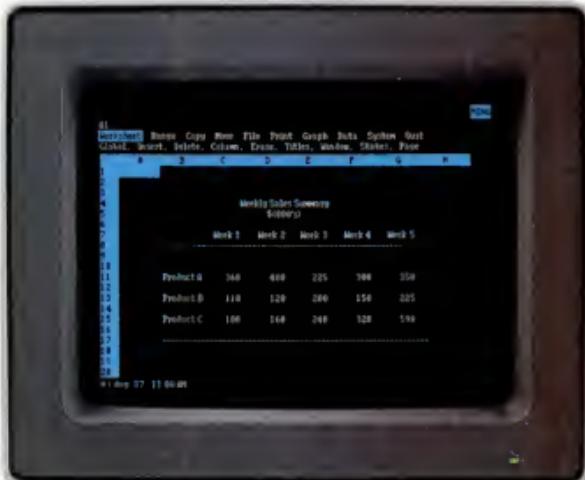
sign. On the front panel, the machine is distinguished solely by the square red reset button that's been added to the minimalist AT front-control panel. There you'll find the expected cylindrical key switch (which provides no physical access protection), along with disk-activity and power indicators. The rear panel of the machine bears a hint that Pan-United has done something right, in the guise of an FCC Class B certification sticker.

No connectors mar the shiny chrome slot-retaining brackets of the standard Micro Lab 386. Instead, the area above the keyboard connector shows a grouping of five D-shell connectors—two parallel port connectors, two serial port connectors, and one video connector.

MORE DISTINCTIONS Pull the lid from the fabricated steel chassis and a few more distinctions appear. The drive bays,



The Micro Lab 386 is a typical AT clone offering 1MB RAM with a 40MB hard disk, EGA display, and mouse for only \$3,697. It supplies both a 3.6-volt 60-millamp-hour Varta battery pack on the motherboard and a set of AA cells attached to the power supply. Once the Varta pack fails, it's a simple matter to restore the CMOS by using the batteries.



Quick-turn the page.

■ 20-MHz 386s

for instance, are arranged AT-style but are split into five half-height bays, each already equipped with its own channels for AT-style mounting rails. The left bay will hold two half-height or one full-height drive but lacks front-panel access. All three right half-height bays (one pair of which will accept a full-height drive) have front-panel access.

Standard equipment puts a 1.2MB half-height floppy disk drive in the top-right slot—a TEAC FD-55GFR in the evaluation unit. The hard disk in the evaluation unit was a 40MB Miniscribe 3053, connected through a standard ST-506 interface. The drive delivered a 29-millisecond average access time in benchmark testing.

Power for these drives and the rest of the system comes from a 200-watt power supply of unknown manufacture with two free device connectors for additional drive expansion. A switched outlet for a display and a voltage selector are available on the rear panel. A battery holder for four AA cells is mounted on the side of the power supply, notwithstanding the 60-milliamper-hour rechargeable nickel-cadmium cell for powering the CMOS memory that's part of the system board.

The system board is built around the Chips and Technologies 80386 chip set. Board layout includes a socket for an optional coprocessor; the choice, according to the documentation, is up to the user and includes an 8- or 10-MHz 80287 or a 16-

20-MHz 80387. No DIP socket for an 80287, however, was visible on the system board. The CPU operates at either 8 or 20 MHz, keyboard selectable. The expansion bus operates at 8 MHz. The 80386 chip installed in the system board actually bore a 16-MHz rating from Intel; this could put your data at risk.

System board memory in the evaluation machine was somewhat unusual—four banks of nine 100-nanosecond 256-kilobit DRAM chips augmented by four 100-nanosecond 256K SIMMs near the front of the chassis. Only the SIMMs are standard equipment. Logically, this memory was divided into 640K for DOS, 384K shadow RAM, and 1,024K extended memory.

The Pan-United documentation claims that this memory operates with zero wait states, but neither system performance nor the speed rating of the DRAM chips bears this out. In a 2MB configuration the memory is, in fact, two-way interleaved between the megabyte banks. The proprietary 32-bit expansion slot accepts up to 16MB, a setup that requires defeating system board RAM.

The BIOS bears a Quadtel copyright. No obvious incompatibilities were detected, and the factory claims that IBM OS/2, Version 1.0, works on the system. The company has no plans to deliver its own OS/2.

SYSTEM SETUP System setup is accomplished through firmware built into the BIOS. Three banks of DIP switches complicate matters, however, although they allow configuration flexibility in enabling/disabling ports, matching the video circuitry to the monitor you want to use, and configuring memory.

The Micro Lab 386 system board circuitry includes the previously noted ports—two parallel, two serial—and the video adapter. This system board bounty means that only one of the expansion slots (six 16-bit, one 8-bit, and one 32-bit slot) is filled with a Western Digital WD1003-WA2 floppy/hard disk controller (which occupies the rightmost 16-bit slot). A Mitsubishi mechanical mouse is also provided as standard equipment to put one of the serial ports to work.

The video section deserves note be-

cause the Pan-United documentation claims some degree of VGA compatibility. This statement is incorrect. The video section of the system board lacks analog outputs and even the digital-to-analog converter required by VGA outputs. Instead, the video section offers enhanced EGA compatibilities, including 640 by 480 resolution with multisync-style displays.

The system board video circuitry, based on Paradise Systems chips, will plug into CGA, EGA, multisync, and IBM-style TTL monochrome displays. It offers

■ Pan-United's claim to some VGA compatibility is incorrect. Instead, the system offers enhanced EGA compatibilities.

compatibility with MDA, CGA, EGA, and Hercules graphics standards on a display that supports the standard you want to use. A light-pen connector is also available on the system board.

The display provided by Pan-United was a Samsung CN-4551, a multisync-style unit with an intrinsic tilt-and-swivel base and a full range of controls on its rear panel (horizontal and vertical size and position, analog and digital input, color compatibility, and text color), and brightness and contrast below the left-front edge of the screen. Unfortunately, the controls have a greater range than the tube can display, and the right side of the image gets squashed long before you can fill the screen with video.

The Pan-United keyboard was made in Taiwan by Chicony Electronics. It follows the IBM Enhanced 101-key design and features full-travel keys with both audible and tactile feedback. The click it makes is somewhat sharper than that of an IBM product, but the keyboard is satisfying to type on.

The speed of the Micro Lab 386 is respectable, and the machine is assembled well. But it is a machine to be wary of be-



FACT FILE

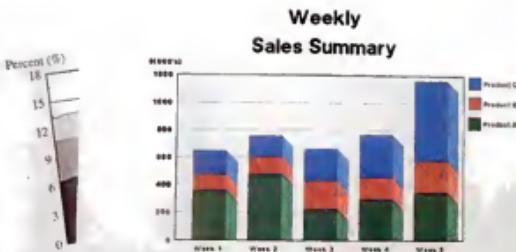
Micro Lab 386

Pan-United Corp.
1967 Route 72, #12
Edison, NJ 08817
(201) 906-8044

List Price: With 1MB RAM, 1.2MB 5½-inch drive, mouse, \$2,797; with 40MB hard disk, 12-inch monochrome monitor, \$3,397; with EGA card and monitor, \$3,697; with VGA card and monitor, \$4,097. 80MB hard drive, \$250; 120MB hard drive, \$750.

In Short: A low-cost, undistinctive machine that's almost an exact copy of the IBM AT in styling, mass storage, and memory. Overall, our benchmark tests tell the Micro Lab 386 is the bottom third of the group.

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■ 20-MHz 386s

cause of its misleading documentation and improperly rated microprocessor in the evaluation unit. Equipped with a properly rated chip, the Micro Lab 386 would deserve consideration by advanced users who do not need detailed guidance.

—Winn L. Rosch

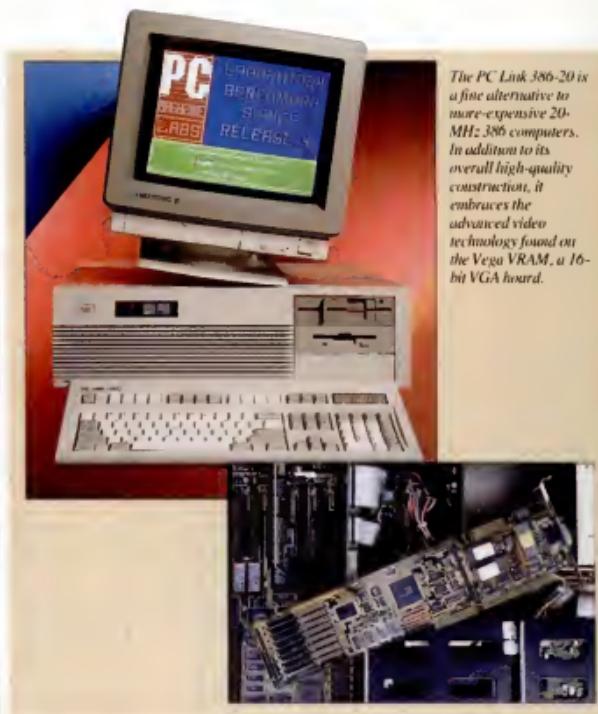
PC LINK CORP.

PC Link 386-20

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The physical aspects of the PC Link 386-20 are plain-Jane pedestrian AT all the way—almost. The sole difference and incompatibility with the AT hardware scheme is the size of the rails used for mounting its disk drives; the PC Link uses narrow metal rails that may make you think twice about trying to add one more drive to its endowment.

Unlike the AT, the PC Link 386-20 earns only a Class A FCC certification, al-



The PC Link 386-20 is a fine alternative to more-expensive 20-MHz 386 computers. In addition to its overall high-quality construction, it embraces the advanced video technology found on the Vega VRAM, a 16-bit VGA board.



FACT FILE

PC Link 386-20

PC Link Corp.
29 West 38 St.
New York, NY 10018
(800) 221-0343
(212) 730-8036

List Price: With 1MB RAM, 1.2MB 5½-inch or 1.44MB 3½-inch disk drive, \$2,495; with 40MB hard disk, \$2,995; with EGA card and monitor, \$3,995; with 90MB hard disk, 2 floppy disk drives, VGA card and monitor, 80387 math coprocessor, \$5,195.

In Short: A good choice in terms of power per dollar, the PC Link 386-20 offers the user moderate performance, high-quality construction, and excellent compatibility at a low price.

CIRCLE 678 ON READER SERVICE CARD

though Class B approval is pending. On the front, you'll see the requisite control panel with cylindrical keyboard lock (it provides no physical access security), plus power and drive-activity indicators. Drive-mounting facilities mimic the venerable AT, with a full-height bay inside and three half-heights on the right. For maximum utility, the inside bay can also hold two half-height drives, and the lowest right-hand bay has optional front-panel access.

On the back you'll find the usual power supply connectors—power in, switched power out, and a slide switch for selecting 115- or 230-volt operation of the 220-watt Tri-Mag unit. In the center, between the power supply and the eight retaining brackets for the expansion slots, are the keyboard connector and cutouts for three 25-pin and two 9-pin D-shell connectors, all blocked off.

SYSTEM BOARD The brain of this product is a Hauppauge Computer Works system board. This incarnation of the Hauppauge motherboard includes four 16-bit and four 8-bit expansion slots, one of the latter also serving a proprietary 32-bit memory expansion connector. Most of the circuitry is built into the Chips and Technologies 80386 chip set. The 80386 is accompanied by a socket for an 80387, filled in the evaluation unit. Both chips supplied have a 20-MHz rating.

Memory is all soldered to the system board, a total of 36 256-kilobit DRAM chips rated at 80 nanoseconds. The four-bit-wide chips allow a four-way interleaving to help match memory to the speed of the microprocessor. Of the standard megabyte, 640K goes to DOS, 256K to extended memory, and 128K to shadow RAM. The BIOS bears an Award Software copy-



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CIRCLE 743 ON READER SERVICE CARD

■ 20-MHz 386s

diag-
AT-like

right and includes built-in configura-
tions routines, and by three
time-of-day clock-to-attached
memory link packed the
AA cells in a 1.2MB 5½-inch
floppy disk to the power supply.

For a 10-MHz ESDI evalvate true 18-millisecond
on PC Labs tests, controlled by a Western
combined floppy/hard occupies one 16-bit ex-
standard equipment, one

filled with an Everest I/O board

leads one parallel and one serial port.

The video output of the tested PC Link 386-20 came from a Video Seven VRAM VGA board, tucked into another 16-bit slot. This wider connection gave on-screen performance a discernible boost. The VRAM VGA is hardware compatible with the VGA standard, featuring only a 15-pin analog output. Its register compatibility proved shy of perfect, however. To match

- The PC Link 386-20's response is like the snap of a bullwhip wielded by a graying old man in full evening dress.

the VRAM VGA, PC Link included a NEC Multisync II display.

The standard PC Link keyboard was an American-made Key Tronic product that follows the 101-key IBM standard. Though lacking clicky audible feedback, it offers a true IBM-like snapover feel, though a bit on the rubbery side.

Although a moderate performer, the PC Link 386-20 may deliver all that you need. With its swift hard disk and video, it is a truly responsive system—the snap of a bullwhip wielded by a graying old man in full evening dress.—Winn L. Rosch

SPEAR TECHNOLOGY INC. Spear 386/20 MHz Tower System

Although it's not the tallest machine in the group, what will first strike you about the Spear 386/20 MHz Tower System is its physical appearance. Towers, in general, have become old hat by now; many are simply standard flat cases turned on edge, with some reorientation of the various status indicators. The Spear Tower, strangely enough, looks as though as it was designed to be vertical from day one, yet stylistic influences from the old AT are as evident as its visual PS/2 texture.

The front panel contains the cylindrical key lock switch and reset button along the left edge of a cantilevered master panel. To the right, recessed into the case, is the system power switch. Between the two are the status LEDs indicating turbo mode, hard disk access, and power on.

The rear of the Tower is inlaid with both main power and monitor power receptacles (as in the old PC-XT). A small recessed switch permits shuttling between 115- and 230-volt input for the power supply if necessary. Midway down the back are the mounting holes for 9- and 25-pin D-shell connectors as well as the keyboard connector. And trailing the group at the base are the access holes for expansion-card end connectors.

Even the keyboard, although physically designed to emulate an IBM Enhanced 101-key model, is stylish. Its tactile response is unobtrusive, and key resistance is kept to a moderate level for a firm but not resistive touch.

While the externals are nice, the Tower arrived at PC Labs loaded with internal goodies as well. The vertical arrangement of its disk components allowed for the installation of a 71MB Micropolis hard disk, a generic 1.2MB 5½-inch floppy disk



The Spear 386/20 MHz Tower System is an impressive performer whose basic configuration, including 2MB RAM, costs \$4,000. It employs discrete logic to control the large 128K cache RAM supplied instead of a cache controller.

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■ 20-MHz 386s

drive, and the lately ever-present, ever-slow 1.44MB 3½-inch drive. There's room for one more half-height drive, which might be dedicated to a tape backup system.

MIXED COMPONENTS The system board is a mixture of discrete and VLSI components, including an 80386 rated properly at its operating speed of 20 MHz. An 80387 coprocessor socket is included; a Weitek adapter board can also be substituted in place of the more pricey 80387.

Eight interface slots traverse the motherboard, with six designed as 16-bit slots—one as an 8-bit slot and another as a proprietary 32-bit slot that can be used also as an 8-bit slot in a pinch. The unavailability of widespread standard 32-bit interface, of course, means that any proprietary 32-bit slot can be filled only by boards (typically memory boards) expressly made for the system by the manufacturer. Unfortunately, 32-bit slots have become a moot issue for 386 architecture; those users who demand their inclusion in every 386 system seem unaware of the low odds that anything will ever fill them.

Couched on the motherboard are also two banks (eight rows) of SIMMs rated at 80 nanoseconds. The tested machine arrived with 2MB installed, with a maximum of 8MB possible (a total of 16MB of 32-bit RAM can be achieved with an expansion card).

Separate from this memory count is the

Spear 386/20. RAM, which runs as much as 128K cache, up to 256K cache expansion card options.

DESIGN INCONSISTENCIES operational characteristics. Tower don't always parallel. design. Although its maximum speed is 20 MHz, it has two sh compatibility modes, 10 MHz and 4.77-MHz standards. The speed is restrained to a mild 10 MHz in order to ensure compatibility with older interface boards originally intended for 8-MHz environments. As you can tell from the speedy execution times for NOP, Floating-Point Calculation, and Conventional Memory benchmark tests, this has no effect on motherboard components (RAM cards and the like), but interaction with slotted components will pay for the compatibility.

One anomaly appeared during the PC Labs benchmark tests aimed at defining disk performance. Although the Spear Tower did have disk caching software installed, its file access times were identical with and without caching in effect. And after several retests, in fact, the hard disk failed with a "sector not found" error message and finally a "drive 0 fault." (The drive and controller are standard ST-506 types.)

Spear does offer a fairly typical repair warranty: parts are covered for 1 full year, and labor is free for 6 months. The only drawback is that the warranty period begins from the date of shipment of the equipment. If you buy directly from Spear, that restriction should pose no problem, but if third-party sales are made, you'll need to acquire an equivalent warranty from the seller.

As a "basic" Spear 386/20 MHz Tower System configuration can look like almost anything, you'll find a wide deviation in the possible prices. A system like the one we tested—with 2MB of memory, 71MB hard disk, 5½-inch and 3½-inch floppy disk drives, and an EGA card and monitor—costs nearly \$5,300.

—Tom Harding



FACT FILE

Spear 386/20 MHz Tower System

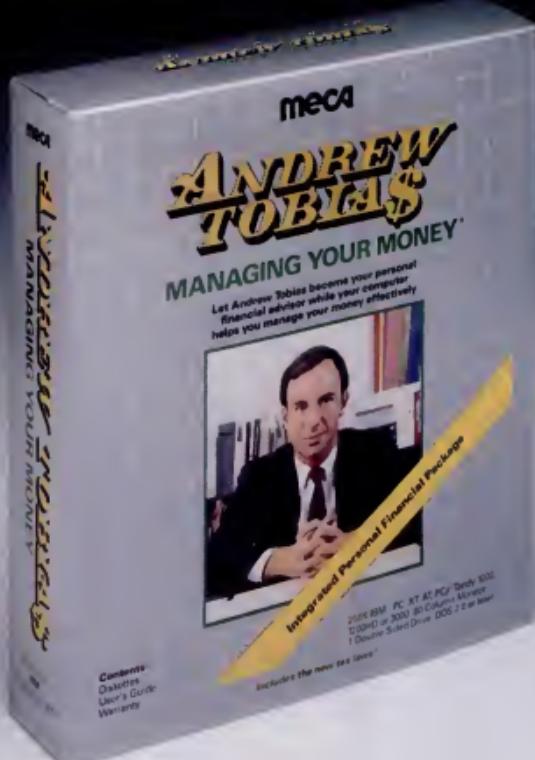
Spear Technology Inc.
710 A Landwehr Rd.
Northbrook, IL 60062-2310
(312) 480-7300

List Price: With 2MB RAM, 1.2MB 5½-inch disk drive, \$4,000; with 71MB hard disk, 1.44MB 3½-inch disk drive, EGA card, and 14-inch EGA flat-screen monitor, \$5,245.

In Short: This tower is a competent 386 workhorse with no exceptional talents. The Spear 386/20 tested in the top tier on processor and memory benchmark tests, and is priced accordingly.

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October 4, 1987

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VIPC COMPUTERS CORP. VIPC Hybrid

A powerful tower, the VIPC Hybrid has the makings of a multiuser workhorse. Its 20-MHz 80386 microprocessor is backed by what VIPC claims is zero-wait-state memory, along with commodious space for mass storage, plus a wealth of built-in ports and features. But while the Hybrid could be a good computer, the system is marred by parts that have to be operated beyond their specifications.

The heart and brains of the VIPC Hybrid is an AMR system board that bears the Hybrid name, somewhat obscured by a glued-on VIPC label. This board features six 16-bit slots, one 8-bit slot, and one proprietary 32-bit slot. In standard configuration, only one of those slots needs to be filled—a 16-bit slot gets the Western Digital floppy/hard disk controller. The evaluation system that was tested filled the 32-bit slot with a memory board and a 16-bit slot with the host adapter of a tape backup system.

Two serial ports, two parallel ports, and a video adapter are part of the system board circuitry. One serial port is attached to a 25-pin male D-shell connector, the other to a 9-pin male D-shell connector. Both parallel ports link to 25-pin female D-shells, and the video port uses a 9-pin female D-shell connector, all located about halfway up the rear panel of the chassis.



The rock-bottom \$1,999 price of the VIPC Hybrid's base unit is its greatest strength. This computer combines SIMM and DIP technology in its memory architecture. One MB of SIMM memory is standard; further expansion on the motherboard necessitates using DIP memory.

The rear panel itself is protected and decorated by a removable fascia panel with break-out holes to accommodate the port connectors. At top rear, is located the fan and voltage selector (115/230 volts) for the 200-watt power supply (of unknown manufacture). A switched outlet is provided for powering displays, and four connectors are available inside for disk drives, all of which were used in the evaluation system. A 60-milliamper hour rechargeable nickel-cadmium battery on the system board powers the time-of-day clock and CMOS memory.

The front of the system unit is crowned with a control panel and a bright red power switch. Located here with the cylindrical key lock and the reset button are turbo, hard-disk-activity, and power LED indicators.

Directly below the controls are three horizontal half-height drive bays with

front-panel access. Hidden below them is a vertical full-height internal bay. Drives are simply screwed into the horizontal bays without mounting rails, and the hard disk nests in a unique slide-in bracket.

HYBRID DESIGN In the evaluation machine, the top bays were filled with one 5½-inch floppy disk drive, one 3½-inch drive, and a TEAC high-speed cassette backup drive (only the first-mentioned is standard equipment). The hard disk supplied was an 80MB Seagate 4096 that delivered a 30-millisecond average disk access time using a standard ST-506 interface with a 5-MHz data-transfer rate. The optional tape backup system affords 60MB of storage per tape.

The VIPC Hybrid is chiefly controlled by two oscillators. One determines the highest speed at which the microprocessor operates, 20 MHz. The second oscillator



FACT FILE

VIPC Hybrid

VIPC Computers Corp.
384 Jackson St.

Hayward, CA 94544

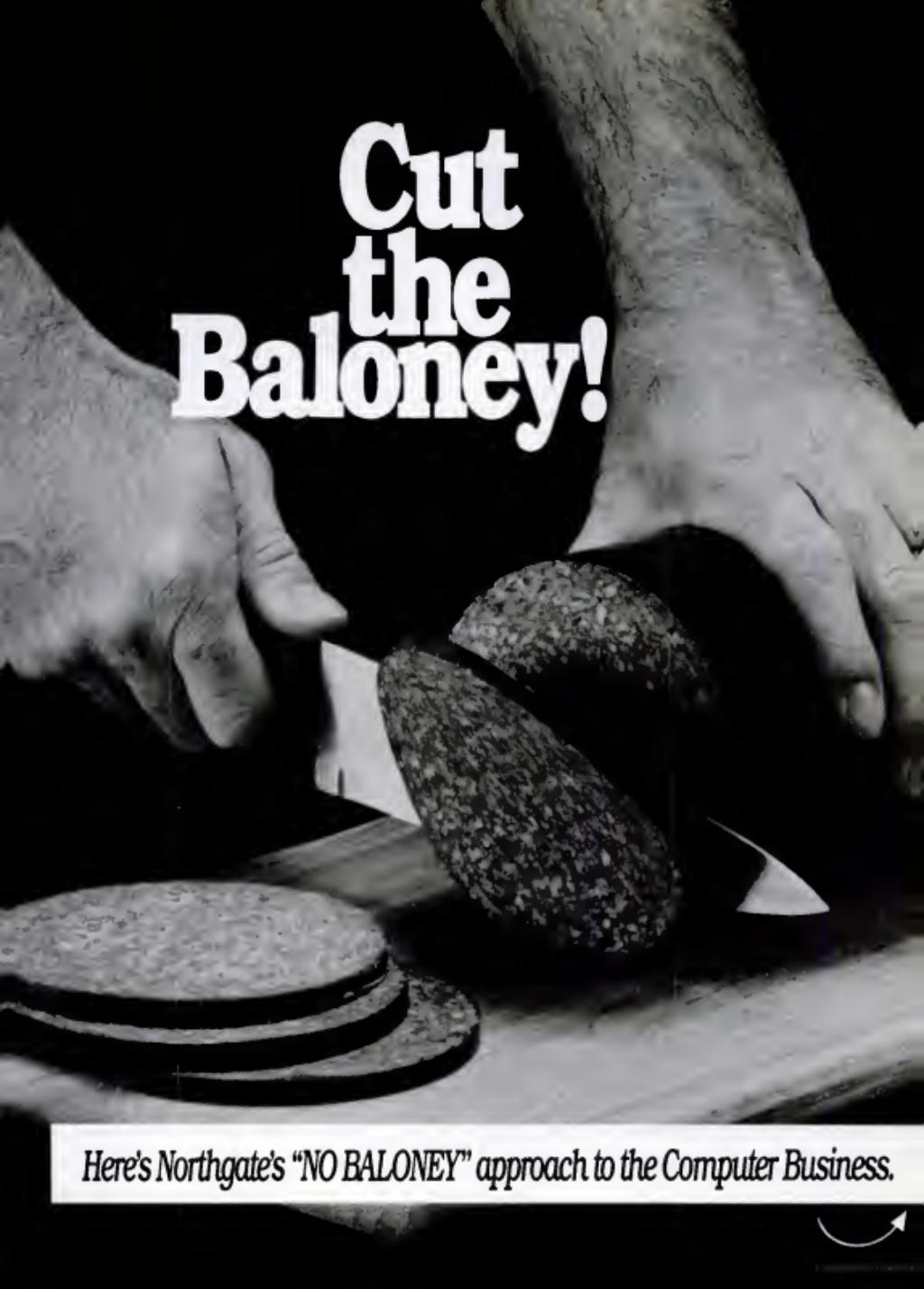
(800) 222-5657 (outside Calif.)

(800) 232-9090 (in Calif.)

List Price: With 1MB RAM, 1.2MB 5½-inch disk drive, \$1,999; with 4MB RAM, 80MB hard disk and 60MB tape backup, 1.44MB 3½-inch disk drive, NEC Multisync EGA/VGA monitor, 80387 math coprocessor, tower case, \$5,999.

In Short: Its best feature is its rock-bottom price; its worst is a 16-MHz 80386 microprocessor with an oscillator to bring speed up to 20 MHz. Overall quality is second-rate; performance is moderate.

CIRCLE #79 ON READER SERVICE CARD



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■ 20-MHz 386s

generates 8 MHz for the expansion bus and for low-speed compatibility-mode operation. Four speeds are available to operate coprocessors: 8 or 10 MHz for an 80287, 16 or 20 MHz for an 80387.

The 80386 microprocessor and 80387 coprocessor installed in the evaluation machine were rated at only 16 MHz. The 80387 would not run PC Labs benchmark tests at 20 MHz and had to be removed for testing the speed of floating-point calculations.

System board memory comprised 2MB in two interleaved banks. One bank was built from 36 100-nanosecond, 256-kilobit DRAM chips; the other, from four 100-ns., 256K SIMMs. Although VIPC and the BIOS setup program indicate that zero-wait-state operation is possible, PC Labs tests did not confirm this was the case. Even if it were possible, 100-ns. chips will not work reliably in true zero-wait-state operation.

■ The video section of the VIPC Hybrid is an EGA Plus board grafted onto the system board.

An expansion board supplied an extra 2MB of 32-bit RAM in the evaluation system. The slot can accommodate up to 16MB; however, locating that much memory there requires defeating the RAM chips on the system board.

The first megabyte of memory is divided into 640K for DOS and 384K for shadow RAM (which can be disabled through setup). All memory beyond the first megabyte is located in the extended addressing

area. The ROM BIOS bears a Quadtel copyright. While this BIOS proved capable of running all the popular software we tried (including *Lotus 1-2-3*, *AutoCAD*, and *WordStar*), it showed poor error handling, jamming at boot-up with no error message when a DIP switch was improperly set.

SETUP FUNCTIONS Most system setup functions are built into the BIOS, accessed by pressing the Ctrl-Alt-S key combination. The same setup program allows altering the operating speed of the system, but such changes cannot be made in mid-data-stream because exiting the firmware utility causes the system to reboot. Some hardware features—video mode and some aspects of the system board ports—must be configured with DIP switches.

The video section of the VIPC Hybrid is essentially an EGA Plus board grafted onto the system board. It supports all pop-

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■ 20-MHz 386s

ular video standards through EGA, including MDA, CGA, and Hercules graphics. In addition, with multisync-style monitors, it is capable of resolutions up to 640 by 480 but is not VGA compatible. You must use a display that supports the standard you choose.

With the evaluation unit, VIPC supplied a Taiwan-made Key Tronic keyboard based on the 101-key IBM Enhanced design. Unlike the Key Tronic model used by the AT&T 6386 Work-Group System and the Everex STEP 386/20, the VIPC gave virtually no tactile or audible feedback. And briefly, during testing, several of its keys mysteriously failed to work, then magically came back to life. A NEC Multisync II display was also provided with the evaluation machine.

The VIPC Hybrid is sturdily made, with a heavyweight steel shell around its fabricated steel chassis. However, its rickety retractable flipperlike feet and rat's nest of internal cables mark the overall quality of the system as second-rate. Add in the fact that its critical parts are operating (and occasionally not operating) beyond their ratings, and buying the VIPC Hybrid may be a risk not worth taking.

—Winn L. Rosch

WHOLE EARTH ELECTRONICS

Whole Earth 20MHz

386 Tower

Anyone who grew up in the sixties will remember *The Whole Earth Catalog*, a wonderful repository of alternative, antiestablishment information covering everything from bean poles to aircraft beacons. Whole Earth Electronics, part of the same organization that now owns the catalog operation, is an alternative source of computer power. The only antiestablishment aspect of the Whole Earth 20MHz 386 Tower is the lack of any visible trace of FCC certification, although the vendor claims the machine has a Class A rating.

Electrically, the Whole Earth Tower holds strictly to the conventions of the PC bus and follows the current trend of using a memory cache to match the high-speed microprocessor to lower-speed memory. In this case, the cache uses 64K of 25-



The Whole Earth 20MHz 386 Tower lacks a 32-bit slot, but its high-speed memory cache puts it on the top half of the list of computers tested in this roundup. It is a particularly good choice for networking.

nanosecond static RAM chips, and main memory comprises one bank of four 100ns., 256-kilobyte socketed SIMMs. This megabyte is split into 640K for DOS and 384K extended memory. Sockets for another bank of four SIMMs are available on the system board. Another socket allows the addition of a 20-MHz 80387 numeric coprocessor.

Two MB is thus the maximum 32-bit capacity of the Whole Earth Tower; of the eight internal expansion slots, two are 8-bit and six 16-bit. Four of these were filled in the evaluation machine. The two 8-bit slots held an Everex serial/parallel adapter and Accelerated Computer Tech floppy disk controller capable of handling up to four drives. Two of the 16-bit slots were filled with a Paradise VGA Plus video adapter (which actually uses an 8-bit interface) and a Western Digital WD1006-WAH hard disk controller.

PC MAGAZINE FACT FILE

Whole Earth 20MHz 386 Tower

Whole Earth Electronics

2990 Seventh St.

Berkeley, CA 94710

(800) 523-8080

(415) 653-7758

List Price: With 1MB RAM, 1.2MB 5½-inch drive, \$3,229; with 44MB hard disk, monochrome card and monitor, 386 memory management software, \$4,349; with 2MB RAM, \$4,879; with 4MB RAM, \$5,999; with 70MB hard disk, 1MB RAM, \$4,649. EGA card and monitor, \$400; VGA card and monitor, \$600.

In Short: A large tower-style computer with six half-height drive bays and a high-speed memory cache that delivers above-average performance. Its only drawback is the lack of a 32-bit slot.

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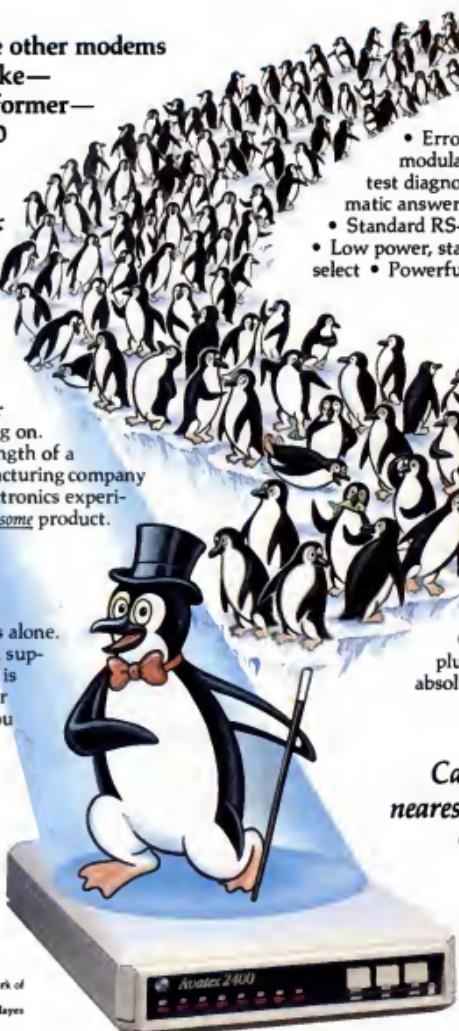
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I am personally asking you to give this keyboard a try. If you don't like it, we'll refund every dime you paid. Guaranteed.

Greg Herrick, President
ZEOS International, Ltd.



PC MAGAZINE EDITOR'S CHOICE

• Dell System 310

It seems you can't go wrong if you buy a Dell. Even in this group of high-powered, solidly built 20-MHz 386 contenders, the Dell System 310 stands out. It may not be flashy-looking, but on our processor and memory benchmark tests it was one of the three fastest computers in this roundup, and it combines top-quality components with a memory cache backed by high-speed main memory at a moderate price. A complete System 310, with 1MB RAM, a 90MB hard disk, one floppy disk drive, VGA card, and Color Plus monitor, costs \$5,199—more than \$1,000 less than a similarly configured Everex STEP 386/20, a machine similar to the Dell in both performance and quality.

Don't eschew the Everex if you've got the extra bucks to spend, however. The STEP 386/20 uses a sophisticated scalable cache to reach top speeds and is designed to eliminate wait states even when reducing speed.

If you're looking for the best digital deal—the machine that delivers the most bang for the buck—consider the PC Link 386-20. Although the PC Link was not the least expensive machine reviewed here, the cheaper units revealed deficiencies that put them out of the running. The PC Link performs at the middle of the pack, and it offers high-quality components and excellent compatibility at a price you'd normally pay for a slower computer.

The system board is labeled as an AMI 386 Series 3, made by Mylex. Most of its circuitry is based on discrete chips, with Chips and Technologies' 82A204 and 82A203 representing the only large-scale integration. It uses AMI/Mylex copyrighted code for system and keyboard BIOS. Both setup and diagnostics are built into the BIOS.

SLEEK TOWER The physical embodiment of this computer is a sleek tower that measures 25½ by 7½ by 16½ inches (HWD). A wide plastic base broadens the tower's footprint to 9 by 18¾ inches. The good looks of the front panel are accented by a control panel midway up that features the power switch, a reset switch, a key lock (which does not prevent physical access), and a nonworking turbo switch. Indicators include power, hard disk activity, and speed.

Above this panel are six half-height drive bays; below, a diagonally grooved blank area. Drives mount in these slots directly, without the need for AT-style rails.

The rear panel is covered by a decora-

tive plastic fascia that snaps off to reveal central cutouts for three 9-pin and five 25-pin D-shell connectors. Inserts can be broken out of the fascia to access sockets mounted here. Expansion slots are located at the bottom of the tower, with the keyboard jack just above them. The power supply crowns the rear panel, with both its input connector and a switched power outlet near the top of the chassis. The fan and a voltage selector (115/230 volts) also can be seen through the fascia.

The steel chassis cover is painted pale beige to match the plastic front panel and rear fascia. Both it and the fabricated steel internal chassis are very sturdy and heavyweight. The only flaw in the cabinetry is a lack of precision. The rear fascia doesn't fit quite right, but otherwise, workmanship is up to the best industry standards.

The top drive bay was filled with a Fujitsu M2553K half-height 5½-inch floppy disk drive; the bottom bay, with a Miniscribe Model 3053 half-height hard disk. The latter uses a standard MFM interface (but with a 1:1 interleave), and it delivers an average access time of about 30 milli-

seconds. The 204.5-watt Senstron SBM-420TK power supply offers four connectors for juicing disks. For six drive bays, that's a paltry allotment indeed.

SOFT BUT SNAPPY KEYBOARD

Whole Earth equipped the system with a Key Tronic EO3435 keyboard, which abides by the 101-key IBM Enhanced layout. It features a quiet but snappy feel that proved pleasant in use.

The system was also accompanied by a Imtec 1455N color VGA display with a 13-inch-diagonal screen. Although the image was bright and sharp, this unit suffered from alignment problems. The combination of the display's short, 48-inch cable and the bottom-of-the-tower location of

■ The Whole Earth
20MHz 386 Tower is a
good buy in looks,
price, and performance.
It's a good choice for
those who need a number
of mass-storage options.

the video adapter made it a challenge to locate the monitor on a desktop.

Whole Earth has also included a number of programs with the system, including *PC-Write*, public-domain utilities, and *SoftBytes 386* (formerly *386-to-the-Max*). DOS is not included. The system does not run IBM OS/2, but Whole Earth promises a version of Microsoft OS/2 for the system by December 1988.

The Whole Earth 20MHz 386 Tower is a good buy in looks, price, and performance. It would make an especially good choice for those who need a number of mass-storage options.—Winn L. Rosch

Tom Harding is a frequent contributor to PC Magazine. Mit Jones is a senior editor of PC Magazine. Winn L. Rosch is a contributing editor of PC Magazine.

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- Enhanced 101-key AT Style Keyboard
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- Real Time Clock/Calendar with 5 Year Battery
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- Built-in System Board LIM EMS hardware drivers
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- 8 Slot motherboard design (6 16Bit & 2 8Bit)
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Standard Pre-Built Configurations:

286/12 With 512K, Hard Disk Drive, Monitor & Video Card					
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- 8 Slot motherboard design (6 16Bit & 2 8Bit)
- Medium foot print case with 5 Disk Drive bays

Options:

- Tower Case • 4MB Interleaving Ram Card
- Custom configurations w/Name Brand peripherals of your choice
- Compaq® Style LCD Portable • Factory Installed RAM Upgrades

Standard Pre-Built Configurations:

286/20 With 512K, Hard Disk Drive, Monitor & Video Card						
Video	Drives	8MB-KVHS	8MB-28MS	16MB-28MS	32MB-38MS	64MB-38MS
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PC BRAND 386/20 \$2100



20 MHz Clock, Zero Wait Operation
Norton SI 24 • Landmark Speed 30MHz
1024K, 1.2MB or 1.44MB Drive, 101-Keyboard

Standard System Features:

- Intel 80386 Processor Operating at 20MHz with Zero Wait States in interleaved mode delivering 30MHz Effective Throughput
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- 1.2MB 5.25" or 1.44MB 3.5" Diskette Drive
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- User configurable I/O timing permitting compatible operation with older peripherals or faster I/O for newer devices
- 8 Slot motherboard design (6 16Bit & 2 8Bit & 2 32Bit)
- Medium foot print case with 5 Disk Drive bays

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- Compaq® Style LCD Portable • 8MB 32Bit RAM Card Upgrade

Standard Pre-Built Configuration:

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- User configurable I/O timing permitting compatible operation with older peripherals or faster I/O for newer devices
- 8 Slot motherboard design (6 16bit & 2 8bit & 2 32Bit)
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Options:

- Tower Case • Factory Installed RAM Upgrades
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Standard Pre-Built Configurations:

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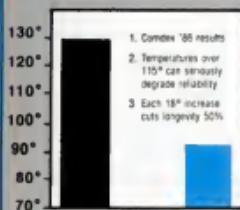


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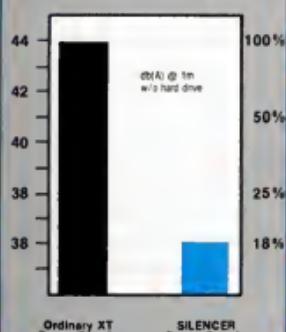
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■ SOFTWARE

A MIDI *Musical Offering*

What PCs did for businesspeople, synthesizers have done for musicians. The electronic marriage of the two technologies, achieved through MIDI (Musical Instrument Digital Interface), is a match made in techno-heaven and a partnership destined to last.

Desktop computers brought undreamt-of analytical and creative power to individuals and freed them from dependence on large, centralized systems. Synthesizers give musicians the same measure of power and freedom. No longer does a strug-

MIDI merges the PC's memory and processing power with the synthesizer's palette of sonic colors to form a complex, powerful music system.

gling composer need an orchestra simply to hear a work played. He can give expression to the full range of his imagination without other musicians or prohibitively expensive recording-studio time.

And just as PCs encourage applications and approaches not found in other computing environments, synthesizers stimulate musicians to create sounds and musical structures that depart from the contexts of traditional instruments.

Synthesizers are a boon for musicians, but they can be even better with MIDI—a standard that allows compatible electronic instruments or other devices to communicate. MIDI merges the PC's memory and processing power with the ever-widening palette of sonic colors that modern synthesizers generate. It links hardware and software from different manufacturers to form a complex, powerful music system.

CENTRALIZED CONTROL From a musician's standpoint, one of MIDI's most obvious advantages is simultaneous control over several instruments. One musician, working from a single MIDI-compatible instrument, can access many other instruments while focusing on the instrument he is directly playing. The controlling instrument can be a keyboard, a MIDI-compatible guitar, or even a wind controller—a device that allows horn players to hook into MIDI technology.

The performer can also specify pitches, volume levels, rhythms, and numerous other musical parameters for any of the instruments that can be used in a MIDI system. The system might include several keyboard synthesizers, drum machines, digital samplers, and other MIDI-compatible devices.

This centralized control is one of MIDI's main strengths, according to Tom Hamilton, a music producer at Sound-Hound, a New York recording studio. Hamilton drives his MIDI system with a Kurzweil keyboard that has no sound-generating capabilities of its own; the keyboard functions as an input device to send musical parameters to MIDI-compatible synthesizers.

The art on the opening page was generated by Passport Design's Score and printed on a laser printer with Adobe's Sonata font.

OTHER MIDI MUSIC MAKERS: ALTERNATIVES TO PC SEQUENCING

Although there are many excellent MIDI programs for the IBM PC, this is not the first hardware for which music sequencing applications have been developed. The Macintosh's graphics interface, for instance, is particularly applicable to music software; both the mouse and the Mac's point-and-click, cut-and-paste editing style are particularly useful in music applications.

Developments in this field are often built on the MIDI protocol, notably in an important sequencer-file standard called MIDI Files. Originally developed by Opcode Systems for the Macintosh and now supported by many Macintosh and PC music programs, MIDI Files stores MIDI data and timing data in a format that can be passed among programs. While it can't reflect the idiosyncrasies of each program's own storage format, the standard at least provides a common ground for trading data among programs.

ON THE MAC Good sequencers are available for the Mac—notably *Performer*, from Mark of the Unicorn—but some innovative music programs are completely different in approach.

Three of the most interesting MIDI programs on the Mac—*Jam Factory*, *M.*, and *Upbeat*—are made by Intelligent Music. *Jam Factory* is a program that makes the computer interact with you while you play music. The program stores music that you play with a MIDI keyboard or other controller and repeats it with various manipulations. *Jam Factory* can rearrange note orders, rotate durations with pitches, and add varying de-

"Any device that is looking for MIDI input can be addressed by this input device," he explains. "This becomes important because I use a number of different instruments. I want to be able to physically play them from one place, and to have the same tactile response consistently."

MIDI gives individual musicians ac-

cess of controlled randomness to what you play. You can interact with the program by "playing in" music and by changing the screen displays, in real time. Several independent musical processes can take place simultaneously.

M combines many of *Jam Factory's* MIDI manipulations with sequencing functions, and *Upbeat* uses the same kind of manipulations as the basis for a creative, practical drum-machine program. All three programs can read and write MIDI Files, allowing the results to be used in sequencers and other programs.

Sound Designer, from DigiDesign, uses Macintosh graphics to facilitate editing digital waveforms stored in samplers. This program can read in the samples and display them on the screen, letting you cut and paste sounds together. It's also very helpful in finding looping points (places where a waveform can be looped with no discontinuity).

Opcode's *DX7 Editor/Librarian*, now updated for the DX7II and TX802, also uses graphics effectively, enabling the mouse to drag envelope points around for instant editing.

ATARI The Atari 520ST and 1040ST computers have captured a strong share of the MIDI market because of their low cost and their icon-oriented GEM operating system. Another attractive feature is Atari's cost-saving, built-in MIDI interface. Many software developers have responded favorably to the Atari's potential, including Dr. T's Music Software with its *Keyboard Controlled Sequencer*

cess to sound textures they couldn't otherwise use. "People have this idea that in order to play a piece of music you need to have a bunch of musicians standing there playing the parts," says Roger Powell, longtime keyboardist with Todd Rundgren's Utopia. "That's not the way that, for instance, paintings are made. Paintings

(KCS) and *The Copyist*, and DigiDesign with *SoftSynth*. Steinberg Research has a particularly powerful and popular sequencer called *Pro 24*.

Hybrid Arts has created a patch editor for the Yamaha DX series of synthesizers called *DX-Android* (formerly *DX-Droid*) that can randomly change patch parameters to create completely new sounds. Another great feature is that you can set up two patches, and *DX-Android* will give you a bank of patches interpolating or gliding from one patch to the other. These features have become so popular that people comparing patch editors often ask whether a certain editor has "Droid" functions.

COMMODORE The Commodore 64 and 128 computers have made the MIDI revolution accessible to many users who couldn't otherwise afford it. Dr. T's KCS in particular gets amazing musical power out of 64K. While its commands are sometimes difficult to use, the program's powerful features rival any sequencer on any other machine; with careful planning, you can make thoroughly professional sequences of several minutes' length. In addition, Dr. T's *Algorithmic Composer* offers MIDI manipulation similar to that offered by Intelligent Music's Macintosh program.

While the Commodore Amiga line's spectacular color graphics lend themselves to powerful music software, quality music software has been slow in coming. The release of the low-priced Amiga 500 has renewed the interest for musicians, however. Programs that have been

ported to the Amiga from other computers include Magnetic Music's *Texture*, Dr. T's KCS, and Intelligent Music's *M*.

THE BIG PICTURE Mainframe computers have been involved in music composition and research since the 1950s. Instead of using MIDI to control dedicated synthesizers, however, most mainframe work has involved manipulating waveforms stored as digital data, which is transformed into sound by digital-to-analog converters, also known as DACs. DACs are used in compact disk players to turn the digitally stored information into sound. Sampling keyboards also use DACs to record or "sample" sound digitally, manipulate it, and play it back.

The advantage of mainframe synthesis and sampling is that instrumental sounds may be created via software; even complex instruments can be simulated with precise control. Some of the most important uses are digital filtering and frequency analysis. High-level languages such as LISP can also be used, allowing computers to aid in composition or do the composing themselves, based on predetermined algorithms.

The disadvantage of using mainframes, besides the cost, is that manipulating digital waveforms directly requires so many calculations that real-time synthesis is usually not possible; in fact, it can take many hours for a complex program to calculate the digital wave forms for a few minutes' worth of sound. But with increased computer speed, many of these barriers are starting to crumble.

—Rick Bassett

stead of traditional magnetic tape. MIDI instruments produce sounds and send them to the computer; the sequencer receives and stores this information. When the recording, or "sequence," is played back, the software feeds the MIDI information to the appropriate instruments.

"Almost all sequencers use the metaphor of a multitrack tape recorder," says Hamilton, "so you have some form of play, fast forward, and rewind." A musician can use these capabilities to jump instantaneously from one point to another within a composition, without waiting for the physical mechanism of an actual tape recorder. Multiple parts, or "tracks," can be overlaid, allowing a musician to build a composition in layers of instrumental sound.

Most sequencers display a graphic image of the work in progress, so a composer can instantly see where he is in a section of music and can easily navigate to any desired place in the composition. Software sequencing also gives the musician a greater freedom of editing and greater flexibility in correcting mistakes than he would have with tape recording.

"We can cut and paste a section of music," Hamilton says, "or we can copy it, or scroll to a specific place in the music. Because we aren't dealing with something as strictly linear as a tape recorder, these things are a lot easier." In addition, working with tape can degrade sound quality because editing may require that sound be copied from one tape to another. Since sequencers work with data instead of actual sound, editing causes no loss of signal quality.

Roger Powell compares sequencers with word processors. "They act pretty much like a word processor when you are creating a document. It's like writing a letter on an old typewriter, and then having someone hand you a word processor; it gives you exactly the same advantages. It's sort of like desktop composition and production."

Convenient storage and retrieval is another advantage that microcomputer-based sequencing gives the musician. As producer Hamilton points out, "An important advantage is the ability to safely store work in progress and reestablish the initial settings very quickly. And to be able to store differ-

don't consist of a bunch of artists standing around with someone telling them what to put on the canvas. For someone who is a composer and performer, this is the only means of realizing their compositions without hiring an orchestra. MIDI gives you an instant box of tools with which you can build your work."

SEQUENCING SOFTWARE While a MIDI system can be constructed without the benefit of a computer, using a computer gives the system some crucial capabilities. Among these, software-based sequencing is by far the most important.

Sequencing is a form of multitrack recording that uses computer memory in-

RIDING THE WAVE OF SOUND SYNTHESIS: THE ORIGINS OF FM SYNTHESIS

The IBM PC Music Feature (see *After Hours*, September 13, 1988) uses a technique of sound synthesis known as *frequency modulation*, or FM. FM has been familiar to musicians working with electronic music for years, and it's also used in many popular synthesizers, such as the Yamaha DX-7, which we used in our sequencer and notation reviews.

To understand the important role of FM synthesis in electronic music, here's a brief historical survey of sound synthesis techniques.

THE SENSATIONS OF TONE Music has attracted the interest of mathematicians and physicists more than any other art form. Ever since Pythagoras, scientists have explored the relationships among the notes of the musical scale and the actual makeup of individual sounds. Art and physics meet in the field of acoustics—the science of sound and hearing. The list of scientists and mathematicians who have studied the phenomenon of music in the past few centuries reads like a roll call: Bacon, Kepler, Descartes, Galileo, Huygens, Newton, Euler, and Bernoulli.

Much of their work, as well as lots of original research, came together in a classic book by Hermann Helmholtz entitled *On the Sensations of Tone* (1885, reprinted by Dover Publications, 1954). Helmholtz explained that a musical tone consists of vibrations of air that can be represented by a complex but periodic waveform. According to the French mathematician Fourier (1768–1830), any periodic waveform can be represented as the summation of sine waves in a harmonic series.

The first sine wave in this harmonic series is known as the *fundamental*. Its frequency (the number of complete wave cycles, or vibrations, per second) determines the pitch of the tone. The second sine wave is twice the frequency of the fundamental and is called the second *partial* (or the first *overtone*). The third sine wave (the second overtone) is three times the frequency of the fundamental, and so forth.

Each of these partials has a different intensity or volume. Taken together, these intensities constitute the *harmonic spectrum* of the sound. The overall intensity determines the loudness of the sound. But the relative intensities of the partials also play an important role: they determine the timbre (or tone color) of a particular sound. A violin and a clarinet sound different, for example, because their harmonic spectra are different.

In theory, once you know the harmonic spectrum of a particular sound, you can reconstruct that sound from the individual sine waves. Although this was not technically possible in Helmholtz's day, the process of synthesizing a sound from its partials is now known as *additive synthesis*. A complex tone is created by the summation of simple sine waves, each of which is one partial in the harmonic spectrum.

SUBTRACTIVE SYNTHESIS Although everyone since Helmholtz has known that additive synthesis is the theoretically correct method to synthesize sound, it proved elusive in practice. To recreate a sound accurately, you need 12 to 24 partials. Most analog electronic circuitry (built from tubes and transistors) cannot create sine waves with the accuracy required for additive synthesis. Additive synthesis had to wait for digital hardware.

In the meantime, most early electronic music synthesizers used analog circuitry and a technique called *subtractive synthesis*. Instruments that used subtractive synthesis became quite popular in the late 1960s with relatively inexpensive synthesizers such as the Moog.

In subtractive synthesis, you begin with a waveform already rich in harmonics, such as a square wave, a sawtooth

wave, or a triangle wave; these waveforms can be easily generated from analog circuitry. A square wave has a woodwindlike sound, while a triangle wave is stringlike. You then pass this waveform through filters that attenuate some of the harmonics.

Of course, it's not this easy. The harmonic spectrum of a real musical instrument changes over the duration of the note. You can hear this quite easily by striking a loud note on a piano and holding down the key. As the tone dies away, the high harmonics disappear before the low harmonics. A synthesized waveform of unvarying harmonics sounds dull, boring, and—the ultimate putdown—electronic.

Therefore, musicians working with analog synthesizers often define "envelopes" that control the overall volume of the waveform and the harmonics attenuated by the filter. This creates a tone with a volume and harmonics that vary over the course of a note.

ADDITIONAL SYNTHESIS PROBLEMS With the availability of fast digital circuitry in the 1970s, it became possible to build specialized hardware capable of additive synthesis.

Sine waves can be generated digitally using a sine wave table stored in ROM. A digital waveform (basically a series of numbers representing the height of the waveform over time) is created by accessing this ROM and multiplying the value by an amplitude that corresponds to the intensity of the partial. The individual sine waves for all the partials are summed together digitally, then passed to a digital-to-analog converter (DAC), which converts the digital data to an analog voltage. The output of the DAC is filtered to remove the rough edges ("audio jaggies") and subsequently passed to an amplifier.

But the same complications exist as in subtractive synthesis: the intensity of

each partial cannot be held constant over the course of a note. The intensities must vary for the sound to mimic real instruments accurately; this involves defining an envelope for each of the 12 to 24 partials used with additive synthesis.

In fact, some researchers showed that the "attack" of a note—the initial sound when a tone begins—is vital to listeners in identifying the instrument that produced the note. These attacks have quite complex spectra, closer to noise than to periodic waveforms; to simulate them, you need a more complex envelope for each partial. Moreover, for notes of different pitch from the same instrument, these envelopes could be quite different.

In short, additive synthesis requires an enormous amount of data if we are to synthesize the sound of real instruments accurately. While still important for scientific investigations into sound, additive synthesis proved to be overly complex and unwieldy for composers.

Recently, "sampling" synthesizers have grown in popularity. These synthesizers capture a sound, break it down into components, and then reproduce it at different pitches. This is a form of additive synthesis that requires comparatively little involvement or control on the part of the user. And some other synthesizers—particularly drum synthesizers—have real digitized sounds stored in ROM and ready for modification. While also a form of additive synthesis, this is more akin to the technology used for storing and retrieving sound on compact disks or digital audio tape.

THE FM SYNTHESIS SOLUTION
Enter Dr. John M. Chowning. While at the Stanford Artificial Intelligence Laboratories in Stanford, California, Dr. Chowning published an article in the September 1973 issue of *The Journal of the Audio Engineering Society* with the forbidding title, "The Synthesis of Complex Audio Spectra by Means of Fre-

quency Modulation." FM synthesis was born.

Chowning's article was later reprinted in the April 1977 issue of *Computer Music Journal* (now published quarterly by MIT Press), and more recently in the book *Foundations of Computer Music* (edited by Curtis Roads and John Strawn, MIT Press, 1985), along with many other articles from *Computer Mu-*

■ Instruments that used subtractive synthesis became quite popular in the late 1960s with relatively inexpensive synthesizers such as the Moog.

sic Journal. With David Bristow, Chowning has recently written a more accessible book entitled *FM Theory and Applications by Musicians for Musicians* (Yamaha Music Foundation, 1986). This book contains many examples that can be applied to the Yamaha DX-7 and other Yamaha X-series synthesizers that use FM synthesis.

Of course, the concept of frequency modulation was not new when Chowning published his article; it had been used for many years in radio transmission. But no one had examined the application of FM to sound synthesis.

FM synthesis, essentially, is a method of generating complex and aesthetically interesting waveforms from very simple means. It is particularly well suited to digital synthesizers. In its simplest form, FM synthesis requires two digitally gen-

erated sine waves. One of these waves is called the *modulator* because it "modulates," or changes, the frequency of the second waveform, which is called the *carrier*.

If the frequency of the modulator is very low (perhaps only a few cycles per second), the frequency of the carrier rises and falls like a siren. Usually, however, the carrier and modulator frequencies are the same or are related to each other in a simple way, defining what is known as the *c:m ratio*; this produces a complex waveform.

The intensity of the carrier determines the overall volume of the tone. The intensity of the modulator affects the relative amplitudes of the partials. As the intensity of the modulator is varied over the course of a tone, the timbre changes in a very natural way.

Although only two sine waves are required in simple FM synthesis, most FM synthesizers use multiple carriers and modulators for a more-complex interaction. Each of these sine waves is called an *operator*. The Yamaha DX-7 has six operators; the ways they can be connected are diagrammed right on the DX-7 case. The IBM PC Music Feature (which uses chips developed by Yamaha and is based on its FB-01 synthesizer) has four operators. For a discussion of multioperator techniques, see Chowning and Bristow's *FM Theory and Applications*.

In his original paper, Chowning admitted that FM synthesis has no relationship to any natural phenomenon. It just works well and makes some good sounds. And that's all that's important. In electronic music, the final arbiter is not the validity of the theory but the sound in your ears.—Charles Petzold

Charles Petzold is a contributing editor of PC Magazine. Between 1978 and 1980 he designed and built for his own use an FM-based digital synthesizer controlled by a Z-80 computer.

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MUSIC SOFTWARE

ent versions of the same piece." A musical creation can be conveniently broken up into smaller files and then assembled as a complete work, in the same way that an author might create a separate word processor file for each chapter of a book.

NOTATION SOFTWARE While sequencing is the major use of MIDI with computers, there are other applications as well. Notation software takes music input, either from the computer keyboard or directly from a synthesizer, and presents it in standard notation. Such packages range from low-end programs that simply capture notes to more-complex programs that output gorgeous manuscripts from Post-Script printers.

Patch libraries are another application for microcomputers in electronic music. *Patches* are specific sounds that are shaped on a synthesizer. Musicians can store the settings that produce these sounds in

patch-library programs that are available for many of the more-popular synthesizers. The sounds are organized for easy recall when a musician needs them.

PC'S GROWING PRESENCE Electronic music is one realm where IBM-standard microcomputing is far from dominant (see the sidebar "Other MIDI Music Makers: Alternatives to PC Sequencing"). Unlike most business users, who consider IBM compatibility an absolute must, music users tend to focus on the functionality and ease of use of a particular hardware standard. Atari and Apple Macintosh machines are more commonly found in MIDI systems than IBM machines, and Commodore hardware also has a visible presence.

"The people who were making 68000 machines made overtures to musicians in their machines long before IBM did," says Charlie Miller, president of Musig, a New York-based MIDI special-interest group.

"They put a voice chip in, and they encouraged developers to produce programs."

"I think it was pretty easy for someone who wanted to develop MIDI software to become a developer for Atari," he adds. "It wasn't until about a year ago that IBM introduced the Music Feature card, but that was almost unnoticeable in the marketing for the PS/2."

Marketing considerations also extend to the way that hardware is sold. IBM equipment generally isn't sold in music stores, and musicians aren't likely to make a special trip to an authorized IBM dealer to look for a computer. As one musician also points out, musicians tend to be somewhat computerphobic: they're looking for a solution, not a computer. So the same features that attract conventional users to the Macintosh, for instance, will also appeal to musicians.

The appearance of the IBM Music Feature card has nevertheless drawn some at-

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CIRCLE 222 ON READER SERVICE CARD

■ MUSIC SOFTWARE

tention to the PC as a music platform, and software for PCs has recently been appearing at an accelerated rate, partly because of the availability of inexpensive clones.

In our reviews we decided to cover sequencers and notation packages, the two most popular types of music software. The number and quality of sequencers have increased as prices have dropped, and there are now excellent sequencer packages available in the \$100-to-\$300 range. We chose to concentrate on sequencers with full editing capabilities and the range of features professional musicians demand.

Our tests were done with a Yamaha DX-7 synthesizer—an FM synthesis keyboard that has become enormously popular—and the ubiquitous Roland MPU-401 MIDI interface.

—Jonathan Matzkin

Jonathan Matzkin is a staff editor of PC Magazine.



Cakewalk

Cakewalk, Version 2.0, from Twelve Tone Systems, is a surprisingly flexible sequencer at any price, let alone for \$150. With an astounding 256 tracks and sophisticated editing features, *Cakewalk* measures up well against even the most expensive sequencers.

While 256 tracks sending out data all at once would certainly cause huge MIDI bottlenecks, having 256 available provides a lot of recording flexibility. With this

many tracks, you can save many versions of the same music and choose among them by muting different tracks. Organizing a large piece can be easier as well, since there is room to split each synthesizer part into several tracks.

Most of *Cakewalk*'s commands are available from a pull-down menu system. *Cakewalk* is designed to take full advantage of a mouse, but keystrokes are usually just as quick. The excellent context-sensitive help makes things even easier by providing an explanation of each pull-down window and most individual commands. At the end of each help screen is a list of available help for related topics.

Cakewalk's main screen is a track listing—typical of many sequencers—showing information on 16 tracks at a time. From this screen, you can control muting, transposition, key velocity, track offset, and channel number, even while a sequence is playing.

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■ MUSIC SOFTWARE

With Version 2.0, *Cakewalk* has added a new graphic editing screen that lets you use the mouse or cursor keys to insert, delete, and move notes. To edit note parameters, you move the cursor over the note and hit Ctrl-Enter, popping up a dialog box that keeps numerical data accessible without cluttering the screen.

For some reason, the note-on time is not included, so while you can edit the note position by pushing it around with the cursor, you have to go to a list display to fine-tune note attacks.

The list display is provided for editing events not accessible through the notes screen. Although list displays can be awkward, *Cakewalk*'s display has features that make it easier to use than many. Note-ons and note-offs are combined into one note line with time and duration for easy editing. Also, you can select any number of tracks to be displayed at one time, so it's easy to perform group editing or to line up a bass note with a chord on a different track. When the cursor is on a note, hitting the Spacebar will play that note.

A remarkably flexible event filter makes global editing easy. It lets you select MIDI data for alteration by specifying ranges of pitch, controller numbers, or any other selection criteria; it even lets you use wildcards.

Other notable features include an SMPTE clock that you can use with all Goto commands, a program to convert *Cakewalk* files to a format readable by Dr. T's *The Copyist II* notation program, and a program to convert *Cakewalk*'s .WRK

files to ASCII. Once your sequence files are in ASCII, you can edit them with a word processor or write your own programs to generate or modify sequences. *Cakewalk Live*, a separate program for \$99, plays song lists and will even load each successive song into memory while the current song is still playing, allowing you to go from one song to the next without skipping a beat.

The addition of the graphic editor is a major improvement to *Cakewalk*. Although the editor does not offer all the features found in other sequencers, you can still do anything you need with little effort. It's amazing that so many features are available in such a well-organized package, at such a low price.

Concepts:One

Concepts:One, Version 1.73, from Midi Concepts, is a powerful 32-track sequencer with many excellent editing options. Designed to harness the power of the AT, *Concepts:One* supports up to 15MB of extended memory on 80286-based machines, and up to 8MB of expanded memory. That kind of power adds up to a lot of notes!

A Parameters menu allows a high degree of flexibility in choosing recording and playback options. You can record different sets of tempo changes in real time and save them to different tracks; you can then select any tempo track to control tempos for the sequence. A clock showing elapsed time in SMPTE format adorns the screen, but you can't select a time to locate a position in the sequence.

The Phrase Editing screen resembles *Sequencer Plus Mark III*'s View screen but has some helpful additions. On this screen, you can cut and paste sections involving units as small as $\frac{1}{16}$ of a beat, a finer resolution than many sequencers allow. You can also store end points for cutting and pasting into 16 edit markers for easy recall later. When a measure contains MIDI data, the box displaying that measure gets progressively brighter as it contains more MIDI data. Besides just looking sharp, this helps when you need to figure out which track is clogging up the MIDI lines.

An odd quirk of the Phrase screen pro-

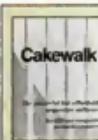
hibits you from changing track mutings except during playback: the muting keys are used for other commands when a sequence is not playing. Several similar confusing keystroke reassessments plague the program. For example, on one screen the Home key resets the sequence to the beginning, as it does on many sequencers. But on another screen you have to hit the asterisk to perform this function, since the Home key is now being used to send an All Notes Off command. Getting around a sequencer is hard enough without such needless confusion.

The Step screen provides a step recorder and event editor on a piano-roll-style graphic display. The end points of the notes are marked with small vertical lines, helping you distinguish between repeated notes and long single notes. A big problem with playback on this screen is that the music must pause every measure for about half a second to redraw the screen. This is less of a problem on faster machines but is still distracting when you're playing through an entire sequence looking for mistakes.

Concepts:One offers other features besides simple sequencing functions. You can record system-exclusive data, including data entered in hex format, and send it out before and during sequences. An extensive live-songlist facility is also included for playing a series of sequences.

MIDI Concepts has chosen to emphasize the special features of *Concepts:One* to such an extent that the first-time user

PC MAGAZINE EDITOR'S CHOICE FACT FILE



Cakewalk, Version 2.0
Twelve Tone Systems
P.O. Box 226
Watertown, MA 02272
(617) 924-7937
List Price: \$150
Requires: 384K RAM,
two disk drives, MIDI in-
terface, DOS 2.0 or later.

In Short: *Cakewalk* 2.0 is an inexpensive sequencer with 256 tracks and powerful editing capability. Not copy protected.

CIRCLE 681 ON READER SERVICE CARD



FACT FILE

Concepts:One,
Version 1.73A
Midi Concepts Inc.
7657 Winnetka Ave.,
#327
Canoga Park, CA 91306
(800) 451-7973
(818) 842-0409

List Price: \$445
Requires: 640K RAM, MIDI interface,
DOS 2.1 or later.

In Short: *Concepts:One* is an option-packed 32-track sequencer with excellent global editing. Copy protected.

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A MIDI VOCABULARY

Clock pulses per quarter note Clock pulses are the smallest division of time for sequencers. A large number of pulses per quarter note helps a sequencer record timing information more accurately, but the recorded sequence thus uses more memory. Some sequencers offer options for this feature.

Continuous controllers In addition to key motion, MIDI can communicate the movement of sliders, wheels, and foot pedals. When the position of a slider or any other "continuous controller" is changed, its position is sent via MIDI on a scale of 0 to 127. A popular feature called *aftertouch* senses how far you've pressed a key after its initial attack, allowing you to control vibrato or other sound qualities while your hands are still on the keyboard. The pitch-bend wheel is a special controller that you can push to bend the pitch of the notes you are playing up or down. Usually measured between 0 and 127, the pitch range can optionally be measured on a scale from 0 to 16,383 (16K).

Event editing Part of the power of sequencers is their ability to allow editing of the smallest details of music. The three most common ways they display notes and other MIDI events for editing are: (1) traditional music notation, (2) graphic notation (usually a bar graph in the style of a player piano roll, with time running from left to right and pitch running up and down), or (3) a list of MIDI events, their timings, and their parameters.

The way individual events are edited determines much of a program's style. It should be equally easy to make large and small changes to one event. Graphic or music notation displays have a command for moving quickly from event to event in order to avoid overuse of cursor keys; mouse support helps. List displays may be simple and accurate, but they consist of long streams of numbers and abbreviations that don't communicate musical gestures intuitively.

Global editing Like database programs, sequencers offer many ways to search through and modify (global edit) MIDI

data. The primary criteria used are track number and location in time. Sequencers can usually copy and cut sections of tracks to buffers and paste them into other parts of the track and other tracks. They should also be able to merge tracks together, or divide them, through various means, including searching by MIDI channel; searching within a specified range of pitch, velocity, or duration; or searching by controller type.

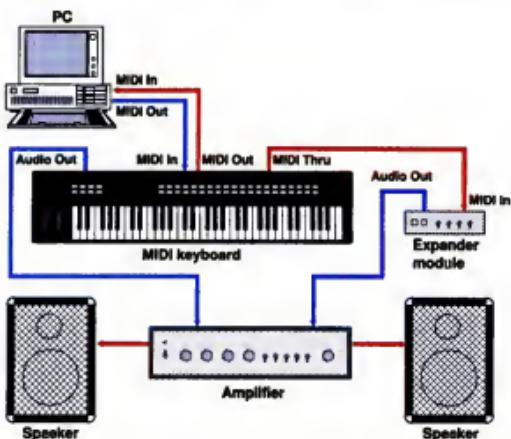
The most-necessary global edits are transposing pitch, converting MIDI channels, and changing tempo within a sequence. It is important to be able to change tempos suddenly or to accelerate and decelerate at any desired rate. The speed of response to MIDI data changes from instrument to instrument and from sound to sound, so it's important to be able to slide one track ahead or behind another by one or more clock pulses to compensate. When looking at a sequencer, it's also important to consider how data can be changed globally. Can you add a constant to all values of a certain



A Simple MIDI Setup

In this configuration, the keyboard is used as a MIDI controller, sending data from its MIDI Out port to the computer's MIDI interface. Sequencer software then records the information. When the sequencer plays the information back, it sends data to the keyboard's MIDI In port to control the keyboard's synthesizer.

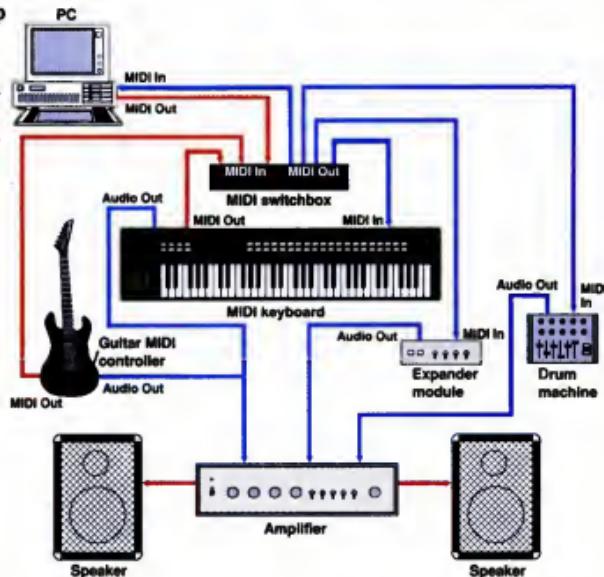
Because a given synthesizer produces a limited range of timbres and a limited number of simultaneous pitches, adding synthesizers increases the available tonal palette; hence the attachment of an expander module—a synthesizer without a keyboard, which can be controlled through MIDI. MIDI data is sent from the computer to the expander module via the keyboard's MIDI Thru port. Notice that sound comes from the audio outputs, not from any MIDI ports.





A Complex MIDI Setup

A MIDI switch box controls the configuration of this version of a complex MIDI setup. MIDI Ins and MIDI Outs can be connected in any combination. A guitar MIDI controller and a keyboard synthesizer are connected to function as controllers. The keyboard, an expander module, and a drum machine are connected to receive MIDI data.



type, multiply their values by a percentage, or scale values from one value to another over time?

Key velocity Like pianos, many keyboards respond to how hard you hit each key, which affects the sound's loudness, brightness, and many other characteristics. Actually, pianos and synthesizers are not responding to the force of hitting the keys but to the speed. MIDI keyboards that detect the velocity with which you hit the keys send out a key-velocity message, saying how fast each key was hit on a scale of 0 to 127. Depending on the MIDI controller, key velocity might reflect other information, such as how fast you hit a drum pad or a guitar string. The MIDI Specification allows keyboards to send the veloci-

ty of key releases as well, though few synthesizers respond to this information.

Looping For music that requires exact repetition, sequencers often have the ability to loop sections of a track or sequence a given number of times. This fits the way much popular music is structured, and it saves memory, since one loop command replaces large amounts of MIDI data.

MIDI channel An identification stamp put on most MIDI messages. MIDI instruments can be set to send or respond to messages on any of the 16 MIDI channels, or occasionally on all of them. Consider two synthesizers connected to a computer sequencer. If a keyboard synthesizer is set to respond to MIDI channel 1 and a synthesizer expander module is

set to respond to MIDI channel 2, even though both synthesizers receive the same MIDI data from the sequencer, they respond only to the data stamped with their respective MIDI channels. A helpful analogy is that of television, which displays only the channel you have selected despite the fact that it is receiving all channels. Some MIDI messages are sent without MIDI channel assignment.

MIDI Time Code (MTC) A new MIDI synchronizing system similar to SMPTE. Several hardware interfaces have been made that translate MTC, but none of the sequencers reviewed here recognize it. See SMPTE.

Playback options Sequencers allow you to decide how a sequence will be

■ MUSIC SOFTWARE

("A MIDI Vocabulary" continued)

played back. Every sequencer lets you change playback speed before and during playback, but you may also want to experiment in other ways with the playback—without having to edit tracks. You can mute tracks, for instance, to hear other tracks by themselves. Some sequencers have a "solo" function that allows you to listen to just one track, muting all the others. You can also transpose a track, change MIDI channels, add an offset to key velocity, or do a simple quantizing operation just for playback, without affecting the track data. The ability to change these options during playback encourages creative experimentation and can save editing time.

Punch in/out Punching in is a technique used with analog tape recorders that lets you fix mistakes in a track by rerecording just a section of the track. A sequencer with a punch-in feature plays back a sequence and lets you start recording (punch in) just before the mistake and stop recording (punch out) immediately afterward. With a manual punch, you hit a key on the computer to start and stop the punches; with automatic, you can set the punch-in and -out times prior to recording. Punch-in times should be allowed in units smaller than measures and beats; mistakes rarely occur on the beat.

Quantization Musicians never play exactly synchronized with each other, not to mention with a computer. Quantizing automatically corrects rhythms, rounding them off to the nearest 16th note, 8th note, or whatever rhythmic value you specify. There are several ways to quantize. The most basic is quantizing the timing of attacks (note-ons); alternative methods include shifting release times (note-offs) to preserve durations when attacks are quantized, and quantizing the releases. You may also want the option to quantize in complicated divisions of the beat (triplets) or to specify quantization in terms of clock pulses.

Quantizing, however, can make music sound excessively mechanical. While "perfectly" synchronized parts may be

desirable for some music, the human stretching and compressing of rhythm often plays a large part in the expressiveness of music. Some sequencers have a *percent quantize* feature, in which a track of music may be quantized by a percentage to move the notes closer to the beats but also to leave enough inaccuracy to let the music breathe.

Sequencer tracks Sequencer tracks are reasonably analogous to a track on a multitrack tape deck. With the latter, tracks can be recorded one at a time, and the player can hear the tracks previously recorded while recording each new track. On sequencers, you can record tracks the same way, except that the sequencer is recording MIDI events, not sound. Each MIDI event is stamped with the time received and stored. On most sequencers, you can give that track a name to help you remember what you played, and you can then edit it.

Most sequencers enable you to change the MIDI channel stamped to a track of data. As you can see in the diagram "A Simple MIDI Setup," we can record the MIDI data from our performance on the keyboard synthesizer onto a sequencer track. We can then alter the MIDI data so that it is stamped with MIDI channel 2 instead of MIDI channel 1. If the keyboard is set to MIDI channel 1 and the expander module to MIDI channel 2, the expander module will now play the notes played previously by the keyboard. We can record new tracks with the keyboard while hearing the previously recorded tracks, and any track may be set to send on any one or sometimes several MIDI channels. Conversely, several tracks may send data on the same MIDI channel, allowing one synthesizer to play many layers of music that could not be played by one person.

SMPTE A time-coding system developed by the Society of Motion Picture and Television Engineers (SMPTE). SMPTE code is usually recorded by a special machine on one track of a multi-track tape deck to synchronize film with

music and sound effects. The moment a tape starts, a machine that reads SMPTE code knows the location on the tape in hours, minutes, seconds, frames, and subframes and can use that information to synchronize with projectors, other tape decks, or sequencers.

Song Position Pointer (SPP) A MIDI message used for most MIDI synchronization. An SPP message gives the location in a MIDI sequence in measures, beats, and subbeats. One sequencer can drive a drum machine or another sequencer by sending an SPP before starting to play, so that all machines start at the same place in the song. Once the song position is located, the machines are kept in sync by MIDI clock pulses.

Step recording An easy way for inexperienced keyboard players to enter notes into a sequencer. With step recording, you set a step size of a quarter note, eighth note, or other time value. Notes can then be played and recorded one step at a time. Hitting the Spacebar or a pedal moves the sequencer to the next step, where you can play new notes or release old ones. A flexible step recorder should make it easy to change the step size while recording, allow steps of any size down to the clock pulse, and allow steps to cross beats and measure lines.

Synchronization Most MIDI interfaces can send out a sync tone that can be recorded on tape for synchronizing the sequencer with tape. The usual format is a tone that syncs to MIDI clock pulses. Additional interfaces may be used for synchronizing with MIDI Time Code or SMPTE standards.

System-exclusive data Each synthesizer manufacturer can designate system-exclusive data to control its MIDI instruments in ways not covered by the MIDI Specification. Some sequencers can now record and play back system-exclusive data at the start or in the middle of a sequence. For example, while loading a sequence, the sequencer can send out patch information to each synthesizer.

—Rick Bassett

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3. Slice the folded edge

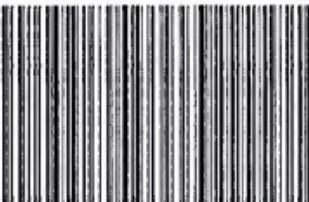
JOURNAL OF CLIMATE

2. Least Lips Cheesewhip

1. Front slide touching the free page

post 8000

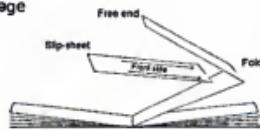
Inverted Foldout slip-sheet



GlossySheet-001

Foldout slip-sheet

1. Open the foldout page
2. Insert this sheet with
 1. Front side touching the free page
 2. Arrow pointing to the fold
3. Slice the folded edge
4. Close the page and slip sheet



Folded edge of the page

1. Follow instructions on the other side

Back

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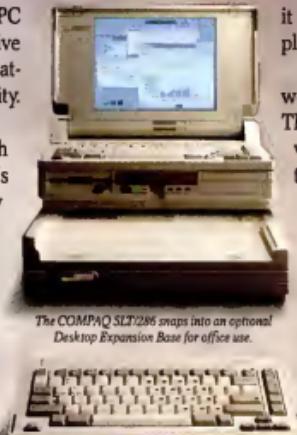
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■ MUSIC SOFTWARE

may find it difficult to figure out the basics. The tutorial helps, but a greater consistency in command style would be even more helpful. Though the program is unwieldy on the surface, there is a lot of power underneath. We look forward to seeing Version 2.0.

Forte II

LTA Productions' *Forte II* is a comprehensive, multipurpose 32-track sequencer. Despite the wide variety of functions it offers, *Forte II* remains easy to use, thanks to detailed context-sensitive help.

Forte II's Track screen displays 16 tracks at a time and allows you to change mutings, velocity offsets, and MIDI channels before or during playback. Each take is saved in a recording buffer, so you don't have to decide which track to use until after you've finished recording. And the program asks for confirmation before overwriting a track with a new take. The punch-in facility is particularly versatile, offering the options of comparing takes and saving separate takes on different tracks.

The Global screen displays measures in small boxes for cut-and-paste operations, in a manner similar to *Sequencer Plus Mark III's* View screen. The Edit screen is a piano-roll-style graphic event editor with a condensed but clear display that leaves room for all note parameters and MIDI events. You can display 2½ octaves of music at a time in the Edit screen—a wider range than offered by any other sequencer.

ers, except *Personal Composer System/2* and *The 48-Track PC*, both of which make use of a graphics card. You also have access to eight buffers, which can store tracks of any length, from both the Global and Edit screens. This makes for extremely flexible editing. You can even name each buffer—a nice touch.

The Edit screen's Block/Buffer mode provides a detailed way of defining buffers for filtering and other transformations. You can define a buffer to hold whatever lies between any two clock pulses, or you can define it by pitch class, pitch and register, controller types, or MIDI channels. Special types of filtering capabilities let you perform such functions as converting controllers (for example, changing modulation-wheel data to aftertouch data). You can also thin out the number of controllers by a percentage you specify—a great way to help prevent MIDI data flow overload.

Forte II's Pattern mode sets it apart from all other sequencers reviewed here. As in *Texture's* Link mode, you can set patterns to loop a given number of times in a sequence. However, *Forte II* allows each track to loop independently. And you can specify points to begin and end a loop (to the nearest 16th note), the number of loops, transposition, and velocity offset. This feature is great for experimenting with overlapping loops and developing complex polyrhythms.

Much of *Forte II's* power comes from a reinterpretation of standard sequencing techniques. For example, you can define quantization in clock pulses independently of the beat. This approach is also a drawback, since it makes some features difficult to use at first and requires extra keystrokes. A macro facility is provided to help in this respect. The program also provides for setting and saving SMPTE cue points, and it can convert between them and Song Position Pointers.

Forte II's looping feature, systematic exclusive recording, SMPTE conversion facility, and powerful filtering and editing make it an impressive package at a very reasonable price. It includes a simple live songlist function for automatically playing a series of sequences—a facility that most sequencers in this price range offer only as an add-on. LTA Productions also makes a drum-machine programmer called *Fwap!*

and an algorithmic sequence generator called *Genie*, both of which are compatible with *Forte II* sequencer files.

The 48-Track PC

The 48-Track PC combines innovative editing power with a comfortable environment: the main screen, which looks like a hybrid mixing board and tape deck, should make the user feel right at home. The program works well with a mouse—you can choose options by pointing and clicking on pull-down menus—but we were able to reach every command easily without a mouse, as well.

You can quantize attacks and releases, specifying any number of subdivisions of the beat up to 1,000, presumably interpolated to the nearest clock pulse. A feature called "smart" quantization moves notes 50 percent closer to the quantizing unit, to increase rhythmic accuracy while maintaining some of the human flexibility of the music. This is a good feature, but it could be improved by allowing you to specify any percentage.

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FACT FILE

Forte II
LTA Productions
P.O. Box 6623
Hamden, CT 06517
(203) 787-9857
List Price: \$250
Requires: 384K RAM,
MIDI interface, DOS 2.0
or later.

In Short: *Forte II* is a 32-track sequencer that can handle complex music with ease. It includes innovative editing and looping capabilities. Copy protected.

CIRCLE #11 ON READER SERVICE CARD



FACT FILE

The 48-Track PC,
Version 3.0j
Robert Keller
2920 Jefferson
Eugene, OR 97405
(503) 485-3481
List Price: \$259
Requires: 256K RAM,
two disk drives, MIDI interface, DOS 2.0 or later.

In Short: *The 48-Track PC*, Version 3.0j, is a friendly tape recorder-style interface in a sequencer with powerful graphic editing and tempo manipulation. Copy protected.

CIRCLE #29 ON READER SERVICE CARD

timing of the track is then stretched or compressed to fit the new beats. You can also use the pitch wheel to record tempo changes while listening to your sequence.

The SMPTE tempo scaling system can save a lot of calculation during film work. You can set markers to two spots in your sequence and assign each of them SMPTE times. The sequence will then be stretched or compressed to fit those times, scaling all tempo changes proportionally.

Another unique strength of *The 48-Track PC* is the graphic display. Notes are represented in piano-roll-style, with a picture of piano keys running up the left side of the screen. When you play a sequence, X's on the keyboard indicate which notes are being sounded. The best thing about this is that you can control key velocity, or any continuous controllers, by drawing curves with a mouse or arrow keys.

An excellent zoom feature lets you view up to 53 bars of the sequence at one time, but the display doesn't scroll during playback. And the sequencer will play only measures shown on the screen, so you can't simultaneously see and hear the whole sequence without stopping and scrolling manually to each new section.

A more serious limitation precludes you from editing notes in detail on the graphics screen; you have to go back into text mode, which involves waiting while the text program is loaded from disk. This is OK for fixing a couple of notes, especially with a hard drive, but it could be exasperating in a long editing session.

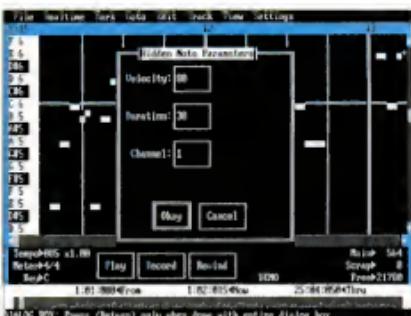
The 48-Track PC combines a simple tape deck interface with unique and powerful editing of tempo and continuous controllers. *The 48-Track PC*'s clock resolution can be set at up to 600 pulses per quarter note, far higher than that of any other sequencer reviewed here.

Even though fine-tuned editing could be made easier, the other features—including recording while looping and conversion of *The 48-Track PC* files to and from ASCII format—make this a versatile program. Although it is copy protected, we are told that when you register your copy, you are sent an unprotected copy.

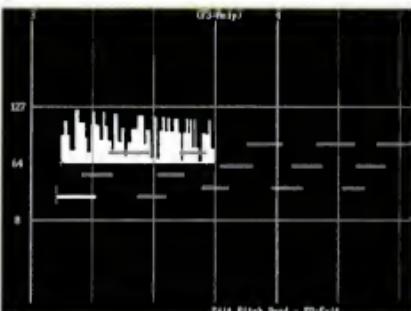
Editor's Note: After *The 48 Track PC* was reviewed, Keller Designs announced a price change in the package from \$259 to

TAKING NOTE OF SCREEN DESIGN

The way a MIDI program displays notes, tracks, and other music information not only gives each program its individual character, but is also indicative of how much editing power the program gives you. These screens are representative of the different ways in which the sequencers and notation packages we reviewed display music data for editing.



Note parameters of Cakewalk may be changed via a pop-up dialog box when the cursor lands on a note. Time runs from left to right, and pitch is displayed vertically.



The 48-Track PC's graphic editor can display pitch and continuous-controller data simultaneously. In this picture, the horizontal bars represent notes, while the vertical bar graph represents pitch-bend information.

\$179. Additionally, the company released *The 64 Track PC*, this \$259 product's features include a new user interface and increased MIDI card support.

Master Tracks PC

Master Tracks PC, from Passport Designs, is distinguished primarily by a friendly user interface and a logical layout. Menu options are clear and easily accessible,

and context-sensitive help is informative and to the point. Despite the fact that *Master Tracks PC* has 64 tracks and many professional features, it has some surprising deficiencies.

Master Tracks PC is a hybrid of a modular sequencer, such as *Texture*, and a standard tape deck-style sequencer. As with *Texture*, you create songs by recording multitrack sections (called patterns) separately and linking them sequentially.

■ MUSIC SOFTWARE

may find it difficult to figure out the basics. The tutorial helps, but a greater consistency in command style would be even more helpful. Though the program is unwieldy on the surface, there is a lot of power underneath. We look forward to seeing Version 2.0.

Forte II

LTA Productions' *Forte II* is a comprehensive, multipurpose 32-track sequencer. Despite the wide variety of functions it offers, *Forte II* remains easy to use, thanks to detailed context-sensitive help.

Forte II's Track screen displays 16 tracks at a time and allows you to change mutings, velocity offsets, and MIDI channels before or during playback. Each take is saved in a recording buffer, so you don't have to decide which track to use until after you've finished recording. And the program asks for confirmation before overwriting a track with a new take. The punch-in facility is particularly versatile, offering the options of comparing takes and saving separate takes on different tracks.

The Global screen displays measures in small boxes for cut-and-paste operations, in a manner similar to *Sequencer Plus Mark III*'s View screen. The Edit screen is a piano-roll-style graphic event editor with a condensed but clear display that leaves room for all note parameters and MIDI events. You can display 2½ octaves of music at a time in the Edit screen—a wider range than offered by any other sequenc-

ers, except *Personal Composer System 2* and *The 48-Track PC*, both of which make use of a graphics card. You also have access to eight buffers, which can store tracks of any length, from both the Global and Edit screens. This makes for extremely flexible editing. You can even name each buffer—a nice touch.

The Edit screen's Block/Buffer mode provides a detailed way of defining buffers for filtering and other transformations. You can define a buffer to hold whatever lies between any two clock pulses, or you can define it by pitch class, pitch and register, controller types, or MIDI channels. Special types of filtering capabilities let you perform such functions as converting controllers (for example, changing modulation-wheel data to aftertouch data). You can also thin out the number of controllers by a percentage you specify—a great way to help prevent MIDI data flow overload.

Forte II's Pattern mode sets it apart from all other sequencers reviewed here. As in *Texture*'s Link mode, you can set patterns to loop a given number of times in a sequence. However, *Forte II* allows each track to loop independently. And you can specify points to begin and end a loop (to the nearest 16th note), the number of loops, transposition, and velocity offset. This feature is great for experimenting with overlapping loops and developing complex polyrhythms.

Much of *Forte II*'s power comes from a reinterpretation of standard sequencing techniques. For example, you can define quantization in clock pulses independently of the beat. This approach is also a drawback, since it makes some features difficult to use at first and requires extra keystrokes. A macro facility is provided to help in this respect. The program also provides for setting and saving SMPTE cue points, and it can convert between them and Song Position Pointers.

Forte II's looping feature, system-exclusive recording, SMPTE conversion facility, and powerful filtering and editing make it an impressive package at a very reasonable price. It includes a simple live songlist function for automatically playing a series of sequences—a facility that most sequencers in this price range offer only as an add-on. LTA Productions also makes a drum-machine programmer called *Fwarp!*

and an algorithmic sequence generator called *Genie*, both of which are compatible with *Forte II* sequencer files.

The 48-Track PC

The 48-Track PC combines innovative editing power with a comfortable environment: the main screen, which looks like a hybrid mixing board and tape deck, should make the user feel right at home. The program works well with a mouse—you can choose options by pointing and clicking on pull-down menus—but we were able to reach every command easily without a mouse, as well.

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CIRCLE 471 ON READER SERVICE CARD



FACT FILE

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Version 3.0j
Robert Keller
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Eugene, OR 97405
(503) 485-3481
List Price: \$259
Requires: 256K RAM,
two disk drives, MIDI interface, DOS 2.0 or
later.

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CIRCLE 479 ON READER SERVICE CARD

MUSIC SOFTWARE

You can change tempo, metronome, count-in measures, and MIDI Thru in real time while playing or recording. Oddly, however, when playback is stopped, you can't access the menu that changes these parameters during playback; you have to escape and call a different menu. A more serious limitation precludes you from adding accelerandos or ritards in the middle of a pattern, although you can specify a gradual change of tempo where patterns meet.

The looping function is strangely conceived. In Pattern mode, you can set a pattern to loop any given number of times, or indefinitely until stopped. You cannot set begin and end points for the loop; you must loop the entire length of the pattern. And looping is impossible during recording, so you can't do continuous drum-machine-like recording, as you can with *Texture* or *The 48-Track PC*. In fact, looping is possible only when one pattern is playing by itself.

In the Track Edit screen, you can do simple global editing such as copying, merging, and erasing tracks. You can also quantize attacks (durations are always maintained), add an offset to velocity, or transpose. You can make these alterations between specified begin and end points, but incredibly, there is no easy way to copy one section of a track to another, or to do any standard cutting and pasting.

The Step screen is where you do Event editing and step recording. This screen shows all note data clearly within a small space, and it has a nice feature for zooming

in and out on the time scale. You can specify a step length for inserting notes, but only using the more-common beat divisions. The graphic piano-roll screen shows only one octave, from C to C, so if your music exceeds these bounds, you must continually redraw the screen. And the screen does not scroll during playback.

Master Tracks PC provides clear, easy-to-use menus and screen displays. This doesn't make up for its lack of editing power, however, especially considering the powerful sequencers now available at significantly lower prices. If Passport Designs chose to improve the editing features, the program's clarity of design could make this a very attractive sequencer.

Sequencer Plus Mark III

Voyetra Technologies' *Sequencer Plus Mark III* is already well known as an extraordinary sequencer. The new Version 2.0 release of the package adds many features to its predecessor, while still maintaining an admirable balance between editing power and straightforward operation.

Sequencer Plus Mark III's main screen displays data for 14 tracks in its default setup. Once you get to know the sequencer, you can remove the help menus and display up to 22 tracks at a time; an EGA monitor will let you push this total to 32 tracks. From the main screen, you can perform standard track recording or change the quantizing and transposition of tracks while a sequence is playing. You can also modify track offset, MIDI channel assignment, muting, and soloing, but not during playback.

The View screen displays tracks horizontally, with dashes representing empty measures and boxes representing measures containing data. Version 2.0 lets you record from this screen, as well as do cutting and pasting, global editing, and filtering. You just put the cursor on the measure in the track where you want to start recording. This is the simplest and most sensible method for recording I've seen; why hasn't anyone done it before?

You can cut and paste multiple tracks with the Block option. And the punch-in feature lets you compare punches and keep partially recorded punches.

The View screen gives you a Trans-



MIDI Sequencing Software: Summary of Features

(Products listed in ascending price order by category)

Sequencing software has developed to the point that many features are found in all the sequencers we reviewed. Since data from continuous controllers, such as Aftertouch, can eat up precious memory, we were glad to find that all the sequencers allow you to filter out such data while you're recording.

All the sequencers can also record with automatic punch-in and punch-out, though the implementation varies quite a bit from product to product. And they can all merge tracks together, convert MIDI channels on a track, and rescale velocity through a track.

Likewise, they can all send and receive song position pointer data, though implementations differ, and they all have some way to edit nonnote MIDI events such as program changes and settings of continuous controllers. And luckily, all sequencers have some form of on-line help.—Rick Bassett



FACT FILE

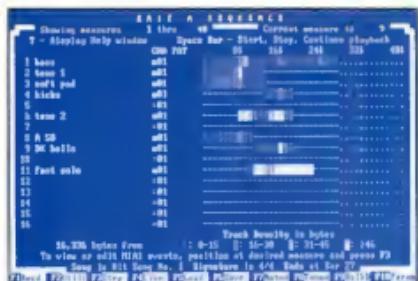


Master Tracks PC
Passport Designs Inc.
625 Miramontes St.
Half Moon Bay, CA
94019
(415) 726-0280
List Price: \$395
Requires: 512K RAM,
MIDI Interface, DOS 2.1 or later.

In Short: *Master Tracks PC* is a 64-track sequencer with a friendly menu-based interface. It combines looping and standard sequencing with some editing limitations.

Copy protected.

CIRCLE 666 ON READER SERVICE CARD



The Phrase Editing screen for Concepts:One shows each measure represented by a box on the right, shaded according to the density of MIDI data.



One of MESA's three screen modes, the Score screen, shows one measure at a time and is used for detailed note editing. Function key assignments are displayed along the bottom of the screen.



This View screen image from Sequencer Plus Mark III displays a block copy being transferred from one group of tracks to another later in the piece.



In Personal Composer System/2's new Event screen, each color represents a different track. A full-four octave range can be shown on the screen at one time.

afterwards. You have the option of repeating patterns with different mutings and tempos. Unlike *Texture*, *Master Tracks PC* saves all patterns as separate files that you later join together in Song mode. The program also allows you to convert an entire song into a single pattern, which you can then link to other patterns.

This system's advantage over *Texture* is that patterns are not nearly so limited in length. The disadvantage is that *Master*

Tracks PC stores repeated patterns as copied data, not just repeat commands, so a song's length is limited by available RAM, unlike the case with *Texture*.

The Pattern mode has most of the necessary recording functions. You can set track length before recording if you wish, and a punch-in feature lets you specify begin- and end-recording points. Since the punch-in feature doesn't automatically turn off notes that are sounding, you have

to punch in and out during silence so you don't erase the command that terminates any notes that are sounding.

If you want to work on a small section of the pattern, you can set begin and end points for playback, but there isn't a Continue feature for playback, so you always have to start at the preset begin point. Another drawback is that you can only specify begin and end points for recording or playback to the nearest beat.

■ MUSIC SOFTWARE

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FACT FILE

PASSPORT

Master Tracks PC
Passport Designs Inc.
625 Miramontes St.
Half Moon Bay, CA
94019
(415) 726-0280
List Price: \$395
Requires: 512K RAM.

MIDI Interface, DOS 2.0 or later.
In Short: *Master Tracks PC* is a 64-track sequencer with a friendly menu-based interface. It combines looping and standard sequencing with some editing limitations. Copy protected.

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□ True BASIC 2.03 (now includes Runtime)	57.
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■ SoftBytes 2.0	35.
■ SoftBytes 366 2.53	49.
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LQ-500 printer (80 col., 264 cps, 24 pin)	call
LQ-1050 printer (136 col., 264 cps, 24 pin)	call
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READING UP ON MIDI FOR THE NOVICE AND THE PRO

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Avoiding the hardware favoritism often abounding in MIDI books, *Music Through MIDI* runs the gamut from the evolution of electronic music to the implementation of your own home or professional studio system. Even if you end up deciding to leave the music up to the pros, this book provides stimulating reading on the automation of the other-

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Taking a little extra time with this book will provide you with an excellent set of MIDI routines. And it will give you the background to write your own MIDI applications—without the torture of the MPU-401 technical reference.

—Constantine Peters

Constantine Peters is an ED/Systems manager at a Wall Street firm and the SysOp for the ENIAC bulletin board.

List Price: *Music Through MIDI*, by Michael Boom, \$19.95. Microsoft Press, 16011 NE 36th Way, Box 9701, Redmond, WA 98073-9717. © 1987. ISBN 1-5615-026-1.

CIRCLE 664 ON READER SERVICE CARD

List Price: *C Programming for MIDI*, by Jim Conger, \$22.95. M&T Publishing Inc., 501 Galveston Dr., Redwood City, CA 94063. © 1988. ISBN 0-934375-86-0.

CIRCLE 665 ON READER SERVICE CARD

forms function—a flexible global filter and editor that's neatly organized into categories of time, pitch, velocity, splitting criteria, and random effects. Among its capabilities are compression and expansion of time, durations, or key velocity; "harmonic" transposition and inversion; splitting of tracks according to a note's duration, its pitch, or how close it is to the beat; and random fluctuation of pitch, start time, duration, or velocity within a specified percentage range. Noticeably absent, however, are ways of altering continuous controllers.

The Edit screen makes detailed editing easy; placing the cursor on a note lets you edit its parameters by means of mnemonic keystrokes, such as D for duration. Although the menu is helpful, it can be removed to display more notes. The actual pitch range spanned on the screen is not as large as on some sequencers, but the dis-

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EDITOR'S CHOICE
F A C T F I L E

SEQUENCER PLUS MARK III

Sequencer Plus Mark III, Version 2.0
 Voyetra Technologies
 333 Fifth Ave.
 Pelham, NY 10803
 (914) 738-4500
 List Price: \$495
 Requires: 512K RAM,
 MIDI interface, DOS 2.0 or later.
 In Short: *Sequencer Plus* is a 64-track sequencer that combines powerful professional features with ease of use. Copy protected.

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Sequencer Plus Mark III superbly balances flexibility and ease of use. Features used most often usually require the fewest keystrokes, but when more-complex functions are called for, the extra commands are easily executed. If you're not ready to spend \$495 for a sequencer, Voyetra also offers *Sequencer Plus Mark II* and *Sequencer Plus Mark I* for \$295 and \$99, respectively. Both of these products are similar to the high-end version but with relatively limited features. You can upgrade to a higher version at a reasonable cost, and files are compatible among all three versions.



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MUSIC SOFTWARE

Texture

Magnetic Music's *Texture* was one of the first MIDI sequencers. It was designed by Roger Powell, a longtime keyboard player with guitarist Todd Rundgren, and was introduced 4 years ago. This 24-track sequencer (Version 2.5r reviewed here) provides a modular recording setup that makes working with repetitive music very easy but also makes the system less flexible than many of the more-recent entries into the field.

In *Texture*'s terminology, music is broken into *patterns*, which are then linked to make a complete piece. A pattern can be up to 2,730 beats long; it can begin or end on any beat or any $\frac{1}{2}$ of a beat. You must record each pattern separately, but you can then splice them to make longer patterns or split them into smaller ones.

In Link mode, you construct a link by assigning it a pattern and specifying the number of times the pattern should repeat within a link. These links are then played one at a time, with no possibility for overlapping. The result is the finished piece. For each link, you can set a relative tempo and a track muting configuration, which you can save and copy to other links. The muting feature is handy for arranging sections with a core group of tracks but with different melodies and background figures on each repetition.

In previous versions of *Texture*, the modular design prevented you from recording long stretches of music. The cur-

rent version compensates somewhat by allowing for single patterns containing up to 545 beats at the default clock setting. At a moderate tempo of 100 beats per minute, you could record almost 5½ minutes of music at one time—enough for many purposes, but still somewhat limiting if you want to record a long performance.

You can set automatic punch-in and punch-out times to the nearest $\frac{1}{32}$ of a beat, which is fine for nearly any application. A nice feature of the Undo option lets you toggle between playing back the original version and the new version of a punch.

One of *Texture*'s most noteworthy features enables you to record while looping through a pattern, a recording technique used by many drum machines. While the pattern is repeating, you can play your part until it comes out exactly as you want. Hitting any key will then start looping your new track along with the rest of the pattern. You can record new tracks while the looping continues, building up dense multi-track textures without skipping a beat. Also, if you like what you played, say, on the second and seventh times through the loop but you don't care for the rest, you can call up the record buffer, take what you created during the loop, and save it to a track. The 48-Track PC has a similar feature but doesn't allow the same flexibility.

Texture provides a list display for event editing. Note-ons and note-offs appear on separate lines, so the note-off for a long note may end up far down the list from its corresponding note-on. You can jump between corresponding note-ons and note-offs, and *Texture* can play each pitch the cursor lands on, which helps you keep your place. Fine-tuning a track is still a lengthy process.

Texture's global editing is versatile, but the end points for ritards, accelerandos, and other scalings over time must correspond with the end points of patterns. Limitations like this make it difficult to create musical shapes that stretch across the patterns.

Fine tuning of events and global editing are not as flexible with *Texture* as with some other sequencers, and the limitation of 24 tracks could be a problem with a complex arrangement using multidimensional synthesizers. But *Texture* is great for arranging pop tunes and music that conforms

to its blocklike structure; in Link mode, you can move verses, refrains, and bridges around quickly and easily.

If you can take advantage of its modular setup, *Texture* is a very good choice. Mag-

PC EDITOR'S CHOICE

- Cakewalk
- Sequencer Plus Mark III

Selecting the best sequencing software is almost as difficult as selecting the "best" composer or style of music. Music is highly personalized, and sequencers other than Sequencer Plus Mark III, Version 2.0, and Cakewalk, Version 2.0—the ones we've chosen—may better suit the needs of some users.

The \$495 Sequencer Plus is a professional sequencer that combines power with transparency of use. Its editing is clear, and its real-time recording allows you to work without having to think about the program. Furthermore, such functions as Transforms combine power for immediate practical editing with imaginative nontraditional uses. The "percentage quantize" options and the randomizing functions are important developments in PC sequencers.

At \$150, Cakewalk 2.0 is priced much lower than any other full-featured sequencer, and its flexible event filter and new graphic piano-roll-style editor are particular strengths. Cakewalk beats higher-priced sequencers in many functions and is a great package for the money.

Two mid-priced sequencers deserve particular notice as well. Forte II holds up well, feature for feature, against Sequencer Plus and has a uniquely powerful Pattern screen. Another, The 48-Track PC, has particularly strong real-time control of tempo, plus graphic editing of continuous controllers.



FACT FILE

TEXTURE

Texture, Version 2.5r
Magnetic Music
RDS, Box 227A,
Mythic Dr.
Minotopia, NY 10541
(914) 248-8208
List Price: \$299
Requires: 256K RAM,
MIDI interface, DOS 2.1 or later.

In Short: *Texture* 2.5r is a pattern-based 24-track sequencer that allows recording while looping within patterns. *Texture* also allows quick manipulation of musical selections. Copy protected.

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■ MUSIC SOFTWARE

netic Music also offers *Texture*, Version 2.5k, which supports the IBM Music Feature, and a \$99 *Texture* songlist program for playing sets of sequences.



Music notation programs have had to solve many complex problems. Notation's heavy use of graphics requires a large amount of processing time for screen display and printing. It also requires storage of large amounts of data.

Software that converts between sequencers and music notation programs must take into account that a musician seldom plays exactly what he or she reads. An exciting performance will have rhythmic inaccuracies and dynamic changes that cannot be notated exactly; they must be suggested by accent marks, notational style, or adjectives. Conversely, a clear score requires intelligent interpretation by a performer to be satisfactorily expressed.

The same dynamic marking at various points in a piece, for example, may require different reactions—depending upon the density of the music, its instrumentation, and its range of pitch. While research is being conducted into questions of computer performance, today's sequencers can accurately share only basic information of pitch, rhythm, and dynamics with notation programs.

Both *Personal Composer System/2* and *MESA* combine a sequencer and notation software into one package. They provide flexibility in alternating between music entered through performance and through notation. *Score* and *The Copyist II*, however, do musical notation only. *Score* is a complete music publishing program that is not presently compatible with any sequencers. *The Copyist II* is simpler to use and converts files from several sequencers, but isn't as complete in its notation abilities.

The Copyist II

The Copyist II, Version 1.5, from Dr. T's Music Software, is a versatile, cost-effective musical notation program. Some corners have been cut to keep its price down to \$249, notably in the screen display, but most important features remain available. And while it offers no playback options, *The Copyist* reads and writes the file formats of several popular sequencers, making it a helpful companion in a complete MIDI/PC setup.

The ability to transcribe sequencer files into music notation is one of *The Copyist*'s strengths. Programs are provided to convert files from popular sequencers, including *Texture*, *Sequencer Plus Mark III*, *Master Tracks PC*, and *Cakewalk*. Each transcription program deals with the special needs of a sequencer file format, including the linking of patterns in *Texture* and *Master Tracks PC*.

Conversion is done in two stages: first from sequencer files to generic "stream" files of note data, then to music page files. During the first part of conversion, options include setting the key signature, bars per line, time signature, and clefs. When converting stream files to notation files, options include stem directions, quantization, bars per line, and staves per page.

The Copyist's score editor can be used to fix up a file transcribed from a sequencer, or to create a notation file from scratch. Staves, notes, and other symbols can usu-

ally be placed anywhere you wish, using the cursor. The cursor can be moved in short or long increments, but using a mouse is considerably faster. Notes can be entered one at a time or through a technique called *music keyboard mode*. In this mode, the QWERTY line of the computer keyboard acts like a movable version of the white notes on a piano keyboard. This method may work well for keyboard players, but for others it will take some getting used to. Unfortunately, pitches cannot be input through a MIDI keyboard.

The Copyist has the flexibility to space notes as you desire, but except for conversion of sequencer files, there is no automatic formatting. Slurs are created easily,

■ The ability to transcribe sequencer files into music notation is one of *The Copyist*'s strengths.

by marking four points on the screen through which the slur is drawn. One drawback here is that slurs and other figures, such as crescendos, are not displayed on the screen or on draft-mode output, but only with a high-resolution printout. Since high-resolution printing takes up to 20 minutes per page, fine tuning of these figures is often impossible.

A score with more than one stave can be split into parts that can be printed separately. Each of these parts can be printed with its own transposition and several other options. The high-resolution print mode creates clear scores and can be used with or without Adobe Systems' Sonata Font for laser printers. Though high-resolution laser printer output created without the Sonata Font is definitely legible, the font included with *The Copyist* tends to be thin; the rests, in particular, are so small that they could cause problems during sight reading. Output with the Sonata Font, however, is excellent.

The Copyist supports any odd tuplets, meters, and beaming combinations and includes a font editor for creating your own



FACT FILE



The Copyist II,
Version 1.5
Dr. T's Music Software
220 Boylston St., #306
Chestnut Hill, MA
02167
(617) 244-6954
List Price: \$249

Requires: 512K RAM; two disk drives; CGA, EGA, or Hercules graphics; DOS 2.0 or later.

In Short: *The Copyist* is an inexpensive but powerful music notation program that can exchange files with many popular sequencers. Copy protected.

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OFF THE BEATEN TRACK: OTHER PC MUSIC APPLICATIONS

Sequencers and notation programs are not the only types of music applications designed for PCs. Programs are being written to take advantage of MIDI in unique ways, and some are written without using MIDI at all. Here are some notable examples.

In case you want to write your own MIDI programs, Roger Dannenberg of Carnegie-Mellon has developed the *CMU MIDI Toolkit*, which is available for only \$20. (Center for Art and Technology, Carnegie-Mellon University, Pittsburgh, PA 15213-3827). The *MIDI Toolkit* provides assembler routines that send and receive MIDI data and timing from the MPU-401 and compatible interfaces. These routines can be called as functions in Lattice or Microsoft C, letting you write your own programs.

Also included are several C programs that can be used alone or with your pro-

grams, including a MIDI record-and-play program called *Adagio* and a transcriber that will print incoming MIDI data to the screen. A manual and fully commented source code for all programs come with the package.

Altech Systems (831 Kings Hwy., #200, Shreveport, LA 71104; (318) 226-1702) recently released *MIDIBASIC/PC*, Version 1.0, a \$99 PC version of the *MIDIBASIC* program Altech developed for the Macintosh. This program accesses the Roland interface with assembler routines that can be called as functions in BASIC.

Since MIDI is essentially a protocol for communicating with synthesizers, it seldom deals directly with sound. Composers and researchers at universities and centers like Bell Labs have used computers in many other ways to explore and manipulate sound.

Craig Harris, president of the Computer Music Association, is porting several popular mainframe programs to run on 286 and 386 machines; among them are Paul Lansky's *Cmix*, the University of San Diego's *Phase Vocoder*, and MIT's *Csound*. These programs read and write digital sound files that can be played and recorded by digital-to-analog converters without the use of MIDI. They also allow you to design your own synthesizers in software.

The most common converter for PCs is the DigiSound MTU-DS16, which converts sound to 16-bit samples at rates of up to 50,000 samples per second in stereo. (CD players convert at 44,100 samples per second in stereo.) For more information, contact Mr. Harris at the Computer Music Association, P.O. Box 1634, San Francisco, CA 94101.

—Rick Bassett

symbols. Up to ten symbols may be used in one file. While it may not have all the options of *Score*, *The Copyist* can handle many types of music at a reasonable price, and it requires less learning time. It is particularly useful if you own one of the sequencers it supports.

Score

Score, from Passport Designs, is a professional desktop music publishing system. With this program you can print a piece with an unlimited number of staves and any amount of rhythmic complexity.

With all this power comes the inevitable drawback: *Score* is hard to use. To use *Score* effectively, you need to be well versed in music notation and savvy about computers and DOS in particular. Even experienced composers will probably find learning *Score* a slow process.

You may organize your music as you wish, but *Score* strongly encourages you to break your score into many separate files. Each staff system, which is usually two to

four bars long, should be stored in a different file. While breaking a score into so many files increases flexibility and speed, it requires some organizing, since an orchestral piece may span hundreds of files.

You may enter any symbol anywhere, at any time. But to get the most out of *Score*, you need to follow a standard entry procedure that is clear and logical but requires calculation and foresight. Using *Score*'s command language, you enter parameters from the computer keyboard to a command line on the screen. For each staff on a page, you first enter the pitches of all the notes, followed by all the rhythms, dynamics, slurs, beams, and other markings. The results are not displayed on the screen until you finish entering a complete set of parameters. While this is a logical procedure, it takes time to get used to and requires some abstract thinking about musical notation. A mouse can help with some parameters, and a MIDI keyboard can be used to enter pitches but nothing else.

Among the programs included with *Score* are two that are used for music for-

matting. Page and Just. Page automatically determines the page layout of the score, taking into account both rhythmic values



FACT FILE

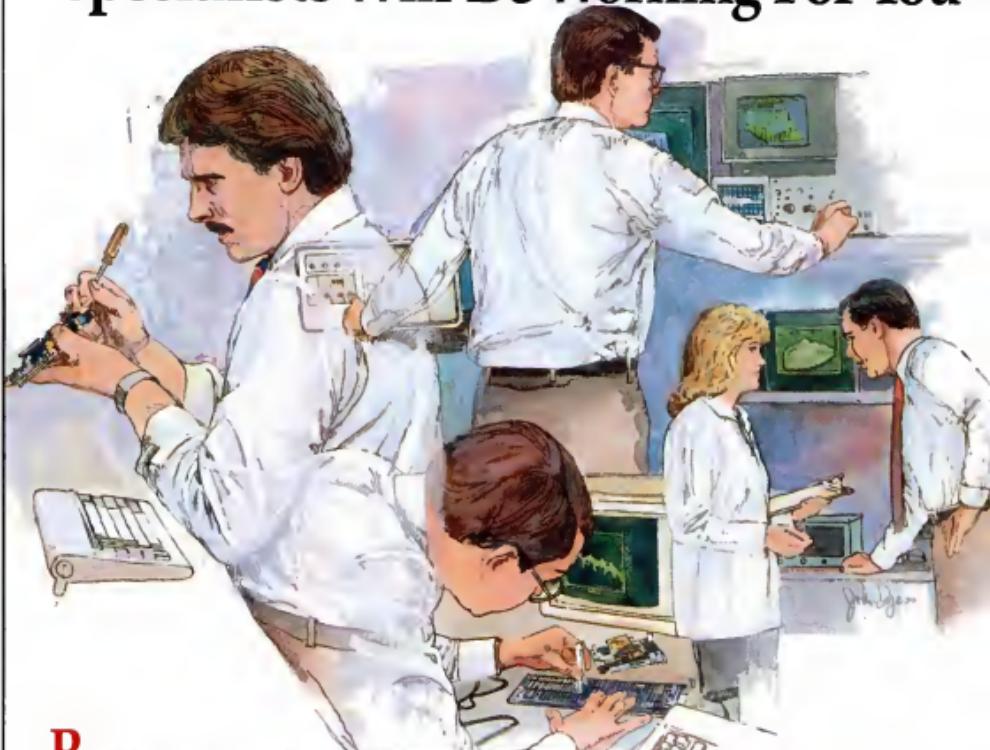
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625 Miramontes St.
Half Moon Bay, CA
94019
(415) 726-0280
List Price: \$995

Requires: 640K RAM,
CGA, VGA, Hercules, or EGA graphics
with color or monochrome monitor; Post-
Script-compatible laser printer, typesetter, or
dot matrix printer; 8087 or 80287 math co-
processor; mouse with Microsoft-compatible
driver; DOS 2.1 or later.

In Short: *Score* is the most powerful music
publishing package available, but it requires a
significant time investment to learn. Not
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and the density of the music. Page also allows you to extract parts, giving each its own transposition. Other options include specifying placement of rehearsal letters and even the amount of time needed for page turns. After being extracted from the score, parts can be edited further. Use the Just program to line up rhythms vertically through every staff in the score, including staff systems spanning many files.

The Draw program is used to create fonts and symbols. Unlike many font programs that create fonts by mathematical functions to draw lines and curves. This allows symbols to be enlarged or shrunk without any loss of resolution.

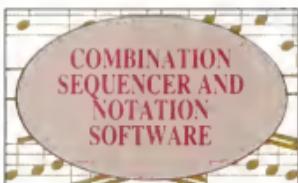
Score has many other excellent features. Many text fonts are provided by the program, and others may be loaded in. Any font or symbol can be arbitrarily sized or rotated. *Score* has its own music font, which yields excellent results on a laser

■ *Score* provides many text fonts. Its music font yields excellent results on a laser printer and publishable results on a typesetting device.

printer and publishable results on a typesetting device. The dot matrix printout is readable and elegant as well.

Although *Score* is not a sequencer, it can play the music stored in a file through MIDI, which is useful for error checking. Programs offering conversion between *Score* and sequencers or the MIDI Files standard could help make this program more accessible.

Score is not a good program for a beginning musician; it requires considerable learning time for an accomplished one. Nevertheless, the design of the program and its manual is thorough and clear, anticipating nearly any problem you might have.



MESA

MESA (Music Editor, Scorer, and Arranger), Version 1.05, from Roland Corp. U.S., combines an eight-track sequencer with a traditional music notation program capable of printing scores containing up to 32 staves. The \$695 program's main strength is its ability to translate music easily between sequencer and notation modes, but unfortunately neither mode stands up well on its own.

Setting up *MESA* on a hard disk is tricky in that the program will rewrite your AUTOEXEC.BAT and CONFIG.SYS files. This forces you to keep separate copies of those files, renaming them and rebooting whenever you use the program.

MESA has three main screens: the sequencer, called Song Mode; an event-editing and notation screen, called Score Mode; and a formatting screen for printout, called Print Mode.

Song Mode displays the eight tracks horizontally across the screen, with a small box representing each measure—similar to "View" screens in other sequencers. The recording scheme combines punch-in/punch-out and cut, copy, and paste functions in a simple, flexible interface. Recording does not go directly onto a track but into the "phrase buffer." After recording into this buffer, you can move the cursor to any track and any beat to paste in what you just recorded. A copy of the music stays in the buffer, so you can modify it or paste in more copies of the music anywhere else.

Unfortunately, muting, looping, and other settings are not always displayed on the screen, except when you change a parameter. Although this saves space, it prevents you from seeing all parameters at once. The only way to see parameters is to change them.

All global editing is done in the phrase

buffer. There are several filtering settings and percentage scaling options, but none that change over time. The global editing procedures are solid but limited. Also, while you can change the tempo in every measure, there is no way to create true ritards and accelerandos. One strength of the program, however, is that it allows you to try global edits on a track or phrase and see the results instantly in musical notation.

After the music has been copied to the phrase buffer, it can be transferred to Score Mode for event editing and notation. Among the transcription aspects you can specify are key signature, type of clef (including piano staves), break point for assigning notes between staves, and quantization. One helpful option, Interpretation, will multiply the lengths of notes by a percentage before quantizing to help eliminate the small rests that creep into notation from staccato keyboard playing. It would be nice to have a "monophonic" option for transcribing single lines, in which the overlap of each previous note is cut off when a new note is attacked.

In Score Mode, the cursor can be moved with or without the mouse for easy note editing. Screen locations are "quantized" to a grid in a way that saves cursor keystrokes and is fine for simple music. For more-complicated rhythms, the grid can be turned off.

If you need help, *MESA*'s manual is clear and concise. It explains basic musical concepts simply and seems geared toward musicians who have little experience with



FACT FILE



MESA
Roland Corp. U.S.
7200 Dominion Circle
Los Angeles, CA 90040
(213) 685-5141
List Price: \$695
Requires: 640K RAM;
two disk drives; Hercules,
EGA, or CGA graphics; DOS 2.0 or
later.

In Short: *MESA* is a sequencer and notation program with a friendly interface and easy notation editing, but it has limited professional use. Copy protected.

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music notation. There are glaring omissions, though; no mention is made, for instance, of how to enter odd triplets other than triplets.

Overall, *MESA*'s menu-driven interface and ease of transferring between sequencer and score formats are effective for standard musical notation, and the program's printouts, while not of professional quality, are extremely legible.

But it's hard for a sequencer to be competitive today with only eight tracks, since the process of merging and unmerging track data is time-consuming and makes organization of a large piece difficult. And the lack of options for complex music notation makes *MESA* of limited use to many advanced users.

MESA streamlines its editing through a great sacrifice of complexity. Neverthe-

less, if you want to play music into a sequencer and see it on paper with as little editing as possible, this program may be the one for you.

Personal Composer System/2

Jim Miller's *Personal Composer System/2* is a jack-of-all-trades and master of quite a few. At \$495, it's a complete music notation program, a 32-track sequencer with a graphic editor, a universal patch librarian, a Yamaha DX-7 series patch editor, and a LISP interpreter for music.

The newest addition to *Personal Composer System/2*, Version 2.0, is its piano-roll-style event editor that displays a full four-octave range. A Zoom feature allows you to see up to 39 measures of 4/4 at one time. The mouse is well supported for moving and changing the time value of notes, and the program's insert ability can be used as a step editor as well. Graphic display on an EGA color monitor can be much more concise than on standard text-based display.

Also, the use of color with an EGA monitor is both a pleasure and a powerful organizing tool. MIDI events can be set to different colors according to MIDI channel, track number, and many other parameters, allowing you to display data from several tracks without a lot of clutter. Of course, this is not nearly so effective on a monochrome screen.

The screen is redrawn during most editing steps, which takes a considerable amount of time, even on a fast 286 or 386 machine. The long reaction time can slow the editing process quite a bit, making it particularly time-consuming to learn the commands through experimentation. And *Personal Composer System/2* offers no online help. Nevertheless, the event screen allows you to accurately edit any MIDI event, and it complements the program's other editing capabilities for considerable power.

The heart of *Personal Composer System/2* is its notation program. Music scores can be created either by transcribing music recorded in the sequencer or from scratch. When transcribing from the sequencer, there are many options regarding staves, key signatures, placement of measure

THE MIDI INTERFACE STANDARD

Since its introduction in the mid-1980s, Roland Corp.'s MPU-401 MIDI processor has set the standard for PC-to-MIDI interfaces. There have been other manufacturers, notably Voyetra Technologies and Music Quest, but they have for the most part followed Roland's lead. A few brave companies have tried to buck the tide by introducing noncompatible alternatives, but Roland's hardware remains the de facto standard.

The future may bring a successor standard that incorporates functionality not found in the MPU-401 but wanted by MIDI musicians. These additional functions might include support for MIDI Time Code and SMPTE, a film synchronization standard. The ability to attach more than one MIDI interface to a PC would break through the current limit of 16 MIDI channels and accommodate the increasing complexity of MIDI sequencing. This capability is already available on the Macintosh.

—Jonathan Matzkin

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numbers, and resolution of transcription (for instance, whether you want the smallest written notes to be eighth notes or sixteenth notes).

Personal Composer System/2 formats the score automatically when you're transcribing music from the sequencer, but it would be nice to be able to format the score at any time. Yet the program is surprisingly flexible when you're editing afterward or entering music directly to the score. This is particularly helpful for complex music, vocal music, or music that breaks normal notation rules. Because of this flexibility, even basic commands like setting up staves can take many keystrokes; fortunately, a macro facility allows up to 2,000 keystrokes per macro. Many long-time *Personal Composer* users have built up large libraries of macros.

As even the updated sequencer doesn't have all the conveniences of many dedicated sequencer programs, several sequencer

ON-LINE MIDI BULLETIN BOARDS

MIDI musicians from all over the U.S. and many foreign countries can communicate via a network of bulletin boards called MIDI-NET. The system originated in the fall of 1986, when several SysOps set aside special message areas on their MIDI bulletin boards to allow sharing of messages among BBSs.

MIDI-NET has grown considerably since then, and it now includes BBSs in most major U.S. cities, in Canada, in Europe, and in Australia. Participating BBSs are compatible with the FidoNet e-mail system; they use a FidoNet utility called Echomail to send posted messages through the system.

The central host system is the Midwest MIDI BBS in Oklahoma City, which is available 24 hours a day at 2,400 bps, N, 8, and 1. The phone number is (405) 733-3102.

—Jonathan Matzkin



FACT FILE



Personal Composer System/2, Version 2.0

Jim Miller
P.O. Box 648
Honolulu, HI 96726
(808) 328-9518
List Price: \$495
Requires: 640K RAM;
hard disk; Hercules, Monochrome, or EGA
graphics; DOS 2.0 or later.

In Short: *Personal Composer* is a high-quality notation program integrated with a 32-track sequencer, a MIDI LISP interpreter, and a synthesizer patch librarian. Not copy protected.

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developers have created programs to translate their files into *Personal Composer* files. The ones we know of are *Texture*, *Sequencer Plus Mark III*, *Cakewalk*, and *The 48-Track PC*. This kind of interaction among programs is excellent—but it can become expensive.

Personal Composer System/2 can use disk space as virtual memory, which means that workspace is limited only by the size of the disk. It's recommended that you use this program with a high-performance hard disk to facilitate working with large files—and also because of disk access time. With *Personal Composer*'s buffer system, reading from floppies will not affect the playback of sequences, but it can cause you to wait a while between screen changes.

Although *Personal Composer* does so many different things, the details are rarely sacrificed. Most commands are very specific, which allows flexibility for the seasoned user but can confuse a first-time user. Nevertheless, each area of the program is thorough, and the combination of them all offers extraordinary power in one program.—Rick Bassett

Rick Bassett is a doctoral candidate in music composition at Columbia University, where he has a teaching fellowship in computer music. He also plays keyboards in several jazz groups in New York City, and he has used MIDI extensively in live performance.

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There's something about a scanner that attracts even the most blasé computerphile. For most of us, it's fascinating to watch a device examine a clipping from a magazine or a snapshot of the family and send it to a computer—then see it emerge later in a sophisticated document. It's an evolving technology that brings text and images to a screen once reserved for the computer's own creations.

Although the scanner can be used for anything requiring data input, it owes much of its appeal to the ever-growing



HAND SCANNERS *I N C H F O R W A R D*

popularity of desktop publishing. Because desktop publishing makes it so easy to combine text with graphics, people expect to see more illustrations. These days a newsletter or logo tends to look unfinished without pictures of people and places in it. Savvy proposals now include a photo of the project leader and the revolutionary widget that will solve Joe Customer's needs. Shop manuals show detailed

If you can live with limited resolution and the occasional wandering scan, handheld scanners are worth a look as a cheaper, space-saving alternative to desktop models.

HANDHELD SCANNERS



Two Approaches to Optical Character Recognition

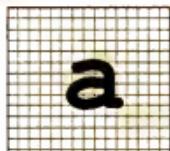
Template Method

The template method, sometimes called font matching, uses a table of predetermined font families (Elite, Pica, Courier, and so forth).

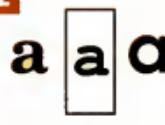
Two major methods of optical character recognition are currently in use: one, based on templates, is used by Saba Technologies; the other, based on topology, is used by TransImage. Each technique offers a degree of assurance and flexibility appropriate for a specific type of OCR work.

If you regularly scan documents composed of font families that the scanner software knows, the template approach has no significant drawbacks. If your work entails loading different font families, however, topological recognition may be better.

1



2



Nominal differences in size and stroke weight are usually allowed for, but in most cases proportional fonts will cause difficulties. Apart from these, a very accurate response rate can be achieved as long as you work with font families known to the scanner software.

As a character is scanned (a lowercase *a* in this instance), a grid is superimposed on it so that its shape can be parsed and then matched against the image of each character within a given family until a match is found.

Once the software determines the match, the chosen character is sent to the output file or application program.

Topological Method

A topological (or feature-recognition) approach, on the other hand, uses the significant aspects of a scanned character to determine its value.

1



The lowercase letter *b*, for example, contains a round belly that might be part of an *o*, a *p*, or an *e*.

2



A section of the scanned character's back bar eliminates the possibility of its being an *o*, because this aspect is common to only the *p* and the *b*.

3



The ascending portion of the scanned character's back bar eliminates the possibility of *p* and causes the software to recognize the character as a *b*.

*This example contains a slight oversimplification; most topological software would first check the scanned character for descenders or other features shared by the smallest number of characters.

images of a component, plus text scanned in from previous assembly instructions. All this is done electronically—with scanned images.

STILL MOSTLY DESKTOP Most of the PC-based scanners available today are not handheld models but desktop devices that scan a full 8½- by 11-inch page. One model, a sheet-feed scanner, requires you to place a document on a roller that pulls it through for scanning. Another popular model, the flatbed scanner, has you place the document on a glass plate; the scanning element then passes underneath and reads the image. These scanners then convert the results into a graphics image—often with a resolution of 300 dots per inch—or into text characters, or both.

Much like their larger counterparts, hand scanners convert graphics, text, or both into a computer image but on a smaller scale. Hand scanners are often shaped like a mouse, sporting the usual tail but also fitted with viewing windows, dials and knobs, and rollers to restrict movement to one direction.

Downsizing has its compromises: these smaller scanners can read a picture only 2 to 4 inches wide or just one line of text per pass. Many have a resolution that peaks at 200 dpi, and you need a steady hand to record a good image. And while some have interface boards that require only a few chips, the more sophisticated devices pack a full-length board with custom chips and memory.

Hand scanners use much the same technology found in larger scanners to translate a hard-copy image into a computer image. When you activate the scanner, it turns on a light source underneath the unit. In simple terms, the unit then measures the amount of light reflected from the picture and converts the highest reading (whites) to 1s and the lower reading (blacks) to 0s. The more sophisticated scanners measure the intensity of the black on the picture and generate dot patterns in the stored image that approximate the levels of gray found in the picture.

GRAPHICS VS. OCR Although both OCR (optical character reader) and graphics hand scanners rely on bit-mapped graphics, there are several differences be-

tween the two. The *graphics scanner* has a row of LEDs, usually red, that span the scanner window located underneath the device and light up the scan area. As you roll the unit over a picture, the graphics scanner reads the image and simultaneously examines a series of notches on one of the rollers. As the notches go by, the scanner can assign the scanned images to a vertical coordinate and create a properly scaled image.

On the *OCR scanner*, however, there is a smaller window on the bottom of the unit about the size of one character. Again, a bright light shines on the document, and the unit scans the text as it travels from left to right across the document.

Some OCR scanners use firmware on the interface board and memory-resident software to look for vertical white space and try to match the image in between the spaces with a library of stored fonts. When a stored character matches, the software passes the character to the application currently running.

Other scanners, however, use a more sophisticated pattern-matching scheme called *feature recognition*. They look at the way the character is shaped—recognizing, for example, that the letter V has two vertical lines in it: one starting at the upper left, the other at the upper right, and connecting in the middle at the bottom. This technique eliminates the need for large libraries of font files and allows proportional fonts to be read.

The software bundled with the package also can vary greatly, both in features and complexity. Some graphics scanner manufacturers give you excellent tools to load, edit, and save an image; others recommend a separate paint program to take full advantage of their scanners. And since images destined for 300-dpi printers can exceed the 640K memory limit, some packages reduce the allowable size of the image, as shown in the performance tests results. Other packages support EMS (expanded memory specification) memory to handle it.

Software for the OCR scanner is usually memory-resident or present in the firmware, and it acts as an alternative keyboard to your application. Font files for a scanner using font-matching techniques can occupy 2 or 3MB of disk space.



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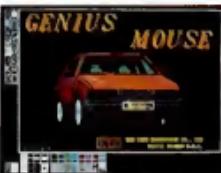
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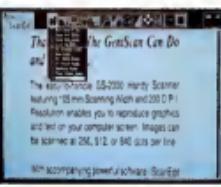
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■ HANDHELD SCANNERS



Summary of Features: OCR Hand Scanners

(Products listed in ascending price order)

The two OCR hand scanners we reviewed use different methods to determine the identity of each character: **font matching** (the template method), which matches the character read against a font in memory, and **feature recognition** (the topological method), a more sophisticated scheme that identifies characters by their overall shape and distinctive features. Your choice among OCR scanners should be determined by the text you'll be scanning and your intended use of the scanned material. If, for example, you'll be scanning a font stored in memory, feature recognition may not be worth the extra price.

Both the Saba and the TransImage scanners use a full-size interface board and a ½-inch-wide scanner window. Both allow you to change the default interrupt request (IRQ) settings, and both use memory-resident software and accept macros.

As pioneers in the OCR hand-scanner arena, the Saba and TransImage scanners share some limitations as well. Reading italics, underlined text, superscripts, and subscripts is still beyond their capabilities. And two other features that would be welcome—flagging unread characters and using a spelling checker while scanning—are not found in either product.

PHYSICAL CHARACTERISTICS		
Saba Handscan	Saba Technologies Inc.	TransImage 1000
\$799		TransImage Corp.
INTERFACE		
Size of unit (HWD, in inches)	1 1/8 x 5 1/8 x 2 1/8	2 1/8 x 6 1/8 x 1 1/8
Number of buttons	5	6
RECOGNITION SOFTWARE		
Memory-resident software uses	160K	16K
Total RAM requirement	512K	384K
No. of programmable button combinations	10	7
FONT HANDLING		
Font matching (automatic or manual)	Manual	N/A
Feature recognition (automatic or manual)	N/A	Automatic
Supported fonts		
ANSI OCR-B	○	●
ANSI OCR-C	○	○
Courier (point sizes)	● (10)	● (8-14)
Elite (point sizes)	● (12)	● (8-14)
Pica (point sizes)	● (10)	● (8-14)
ITC family group	○	● (most fonts in most sizes)
Other	○	●
CHARACTER HANDLING		
Reads boldface	○	●
Recognizes proportional fonts	○	●
Max. scanning speed on PC-XT (cps)	9	40
Max. scanning speed on PC AT (cps)	30	40
TEXT HANDLING		
Accepts scanner input as if typed from keyboard	●	●
Automatically loads ASCII text into application	●	●
Saves output to ASCII file	○	○

●—Yes

○—No

N/A—Not applicable; product does not use this method of character recognition.

HANDHELD SCANNERS



Performance Tests: OCR Hand Scanners

While text scanners have progressed far beyond the ability to read only specialized OCR font families, there are still more improvements to be made. The Saba Handscan uses a template scheme to recognize characters in a scanned image, which means you must preload a typeface before you start scanning. If no matching typeface exists, there will be no recognition.

Although scanners using the template scheme do offer a wide variety of font families, the Handscan does not currently support proportional fonts; therefore, the ITC font families in our tests were discarded. Even the 10-point Courier, which is a supported font, was not entirely successful, although the scanner did surprisingly well with 8-point Courier using its built-in magnification switch. At normal size and stroke weight, the Handscan was successful with Pica and Elite type.

The Transimage 1000 uses a topological or feature-recognition scheme. By examining specific characteristics (descenders, ascenders,

rounded bowls, floating dots, and the like), this scheme identifies a scanned character on the basis of its contours. In general, the Transimage scanner was more robust in its ability to recognize a wide variety of font families, whether proportional or not, although it worked best in the 10- and 12-point ranges.

For the sake of comparison, we are including test results for the Kurzweil Discover 7320 (for a review, see "Scanners Take Off," PC Magazine, October 13, 1987). The Kurzweil, of course, breezed through the tests, performing flawlessly with normal Pica and Elite types. Proportional fonts and a wide variety of type sizes posed no obstacle for this scanner.

Neither of the OCR hand scanners worked well in the minimal 10 percent gray mode; error rates increased dramatically, as the test results show. But since the Kurzweil uses an automatic feeder assembly designed to accept one sheet at a time, it could not handle a page of text with an overlaid acetate sheet; consequently, PC Labs was not able to conduct a gray-scale test on it at all.

In the following sets of boxes, we reproduce a portion of the original test manuscript in a given font and point size, along with the same text as read in by each of the three tested scanners.

Normal Pica Tests

Original

The world of alternate input devices share of eccentric gizmos crusading QWERTY keyboard and the Microsoft Mouse.

Saba Handscan

0% gray	10% gray
99.6% success	77% success

The world of alternate input devices share of eccentric gizmos crusading QWERTY keyboard and the Microsoft Mouse.

Kurzweil Discover 7320

0% gray	10% gray
100% success	N/A

The world of alternate input devices share of eccentric gizmos crusading QWERTY keyboard and the Microsoft Mouse.

N/A—Not applicable; the Kurzweil Discover 7320 could not perform this test.

Transimage 1000

0% gray	10% gray
100% success	63.2% success

The world of alternate input devices share of eccentric gizmos crusading QWERTY keyboard and the Microsoft Mouse.

Normal Elite Tests

The world of alternate input devices share of eccentric gizmos crusading to tear you Microsoft Mouse. Some of them offer t

Saba Handscan

0% gray	10% gray
69.2% success	0% success

The world of alternate input devices share of eccentric gizmos crusading to tear you Microsoft Mouse. Some of them offer t

Kurzweil Discover 7320

0% gray	10% gray
100% success	N/A

The world of alternate input devices share of eccentric gizmos crusading to tear you Microsoft Mouse. Some of them offer t

N/A—Not applicable; the Kurzweil Discover 7320 could not perform this test.

Transimage 1000

0% gray	10% gray
99.6% success	34.5% success

The world of alternate input devices share of eccentric gizmos crusading to tear you Microsoft Mouse. Some of them offer t

To test the OCR scanners, PC Labs tried the devices on manuscript printed in a variety of common typefaces and sizes. Though we tested text samples done in Courier, Helvetica, Times Roman, Bookman, Schoolbook, and Palatino, we report only the results for 10- and 12-point Courier and 10-point Helvetica, along with the two common typefaces Pica and Elite in 10-point, or "normal," size. Besides reproducing the 0-percent-gray-scale version of the text each scanner scanned in, we note the percentage of characters successfully reproduced from text with 0 and 10 percent gray scales.

Gray-scale values were introduced because testing the hand scanners on clean printouts in various fonts was only

part of the task. Not all documents are composed of clean, crisp type. Xerographic copies and newspaper do much to reduce the legibility of characters, as well as reducing the contrast between the background paper and foreground type.

To test worst-case scanning, PC Labs used PageMaker to create a document with five shaded boxes containing progressive gray scales of 10 to 80 percent. This document was printed to a 3M overhead-projector acetate sheet with a QMS PS-800 Plus laser printer having 300 dpi per inch resolution. Once satisfactory scanning was accomplished for a particular font family and point size, each shaded box was placed over the same text and the scanning process

was repeated through each of the possible gray scales.

Because the refractive and reflective properties of the "clear" acetate itself (without recourse to any artificial graying) would alter the contrast of the scanned test document, we expected satisfactory results only with gray scales of 0, 10, and 20 percent. At 10 percent, the equivalent document would be an old, yellowed newspaper. At 20 percent gray scale, with the added effect of the acetate, an equivalent document could well be any text printed on a darker-colored paper stock. In fact, the 20 percent proved impossible for the hand scanners, and the gray scale was limited to 10 percent throughout.

10-Point Courier Tests

Original

The world of alternate input devices is eccentric gizmos crusading to tear you Microsoft Mouse. Some of them offer t

Sabia Handscan

0% gray
96.2% success
10% gray
0% success

The world of alternate input dev
ol t|eccentric gizmos crusading
the Microsoft Mouse. Some of th

Kurzweil Discover 7320

0% gray
100% success

10% gray
N/A

The world of alternate input dev
eccentric gizmos crusading to te
Microsoft Mouse. Some of them o

N/A—Not applicable: the Kurzweil Discover 7320 could not perform this test.

TransImage 1000

0% gray
96.5% success

10% gray
70.3% success

The world of alternate input dev
eccentric gizmos crusading to te
Microsoft Mouse. Some of them o

12-Point Courier Tests

Original

The world of alternate input dev
share of eccentric gizmos crusad
OWERTY keyboard and the Microso

Sabia Handscan

0% gray
63.4% success

10% gray
0% success

The world of alterDate inQuT d
Of BCCentr]G qizmos GKUSkd]Bq K
thO M]Gro\$oft MCUEO. KomG ot th

Kurzweil Discover 7320

0% gray
100% success

10% gray
N/A

The world of alternate input dev
eccentric gizmos crusading to te
Microsoft Mouse. Some of them o

N/A—Not applicable: the Kurzweil Discover 7320 could not perform this test.

TransImage 1000

0% gray
100% success

10% gray
63.6% success

The world of alternate input dev
eccentric gizmos crusading to te
Microsoft Mouse. Some of them o

10-Point Helvetica Tests

Original

The world of alternate input devices seems to attr
tear you away from the QWERTY keyboard and the
others a good belly laugh.

Sabia Handscan

0% gray
0% success

10% gray
0% success

hewor!do!s!!ernmeinpmpdevloessser
mosmussdmolo

Kurzweil Discover 7320

0% gray
97.9% success

10% gray
N/A

The world of alternate input dev
eccentric gizmos crusading to te
Microsoft Mouse. Some of them o

N/A—Not applicable: the Kurzweil Discover 7320 could not perform this test.

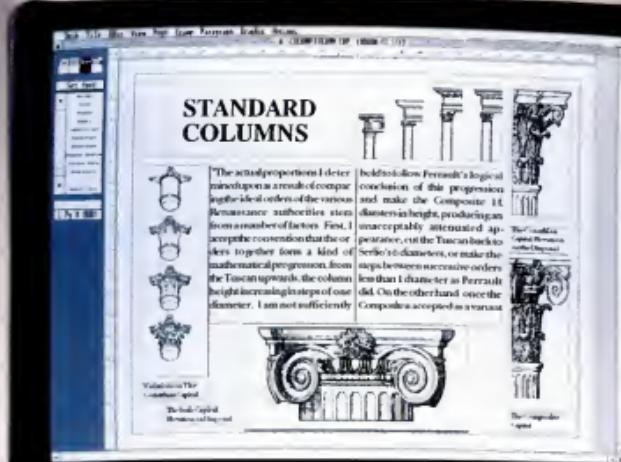
TransImage 1000

0% gray
99.2% success

10% gray
34.6% success

The world of alternate input dev
eccentric gizmos crusading to te
Microsoft Mouse. Some of them o

The Stan



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■ HANDHELD SCANNERS

BETTER PRICE AND CONTROL So why should you pop for a hand scanner instead of saving for a full-size one? Part of the answer may be that although prices have dropped substantially over the last few years, the cheapest full-page scanners still start at about \$1,000. The two OCRs reviewed here cost \$799 and \$2,950, but—a far cry from desktops—the four graphics scanners included range from only \$249 to \$349. Hand scanners, in addition, are smaller and more maneuverable. And you have more control over the scan area and the angle of scanning.

Handheld OCR scanners allow you to be more selective of the text you want to read. At least one manufacturer of facsimile boards for the PC (see "Getting the Fax," PC Magazine, June 28, 1988) has software that can take the logos and signatures scanned with its unit, integrate them with letters from a word processor, and fax them using the PC.

Although there seem to be several reasons to buy a hand scanner, it's nevertheless a tough decision. OCR scanners like Saba's Handscan, for instance, ease the pain of reloading old documents and fill the void left by mainframe systems that can't transfer information from reports to a user's PC. In contrast, handheld graphics scanners offer no additional functionality over full-page scanners.

A company that just spent \$5,000 to \$10,000 for a desktop publishing unit will probably invest a little more to get the full-page capabilities. The software used to merge fax letters is interesting, yet it remains cumbersome and time-consuming. But for small-business and home users, the price difference is nothing to shrug off. A 2- to 4-inch-wide image, in fact, may be enough for their applications.

Changes and exciting innovations are common in the scanner industry, among them combination graphics/OCR hand scanners, so what you need but can't get today may just be around the corner. In the past 2 years, vendors have developed much-more-sophisticated software for reading and changing scanned images. Kurzweil Computer Products, a Cambridge, Massachusetts-based manufacturer of desktop scanners, recently announced a scanner for the blind that examines a page and then vocalizes the



Performance Tests: Graphics Hand Scanners

In testing this latest generation of hand scanners, black-and-white line art did not prove much of a challenge, although the Packard Bell scanner, teamed with GEM Scan support software, consistently converted the circular polar grid into concentric ellipses.

Halftones, however, were a completely different story. Both the Packard Bell and The Complete PC hand scanners were extremely sensitive to the gray tones in the photo and recorded much of the off-white as some level of gray. The Logitech and DFI scanners assumed that the lowest-level gray was to be represented as white and produced a cleaner image.

Overall, price will tell: none of the tested hand scanners could match the halftone recognition of the \$9,950 Kurzweil scanner we used as a standard of comparison.

PC Labs compared the four graphics hand scanners' output head-to-head and also matched them with the Kurzweil Discover 7320 desktop model's output in a test suite designed to examine their performance in four areas:

- line art with simple blacks and whites and no grays.
- multiple-line resolutions, as you might find on graph paper or a blueprint.
- unscreened gray tones that might appear in a photo; and
- prescreened gray scales representing images in newspapers or magazines.

PC Magazine's art department provided the basic testing materials: a copy of the PC Magazine logo for line art, a polar graphic grid for multiple-line resolutions, a portrait of PC Magazine's assistant manager Wendy W. Huang for the photo, and a gray scale generated with PostScript and printed on a high-resolution typesetting machine.

Original art



Halftone scan

MAGAZIN

Logo scan



Line-art scan

Gray-scale scan

The Complete PC

The Complete Hand Scanner



Halftone scan

MAGAZINE

Logo scan



Line-art scan

Gray-scale scan

Diamond Flower Electric Instrument Co. USA Inc.

Handy Scanner HS-2000



Halftone scan

MAGAZINE

Logo scan



Line-art scan

Gray-scale scan

Logitech Inc.

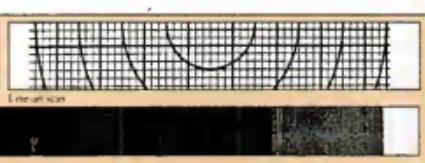
ScanMan



Halftone scan

MAGAZINE

Logo scan



Line-art scan

Gray-scale scan

Packard Bell

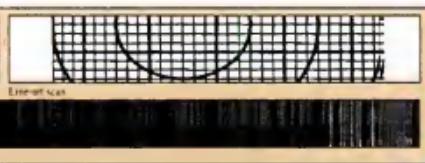
PB-PS1000 Pocket Scanner



Halftone scan

MAGAZIN

Logo scan



Line-art scan

Gray-scale scan

■ HANDHELD SCANNERS



Summary of Features: Graphics Hand Scanners

(Products listed in ascending price order)

All the graphics scanners we reviewed come with a half-size interface board and an 8-pin mini DIN connector, and all offer adjustable contrast. None has evolved as an adequate alternative to the older, more advanced desktop models, but this does not mean that users will have long to

wait. Newer models' ratings of up to 400 dots per inch are already overshadowing the 200-dpi resolution offered by the four scanners reviewed here. And an image larger than 2 to 4 inches wide will be scanable in multiple passes, followed by automatic merging of the separate portions of the image.

PHYSICAL CHARACTERISTICS	The Complete Hand Scanner \$249	Handy Scanner HS-2000 DFI Inc. \$299	ScanMan Logitech Inc. \$299	PB-PS1000 Packard Bell \$349
Size of unit (HWD, in inches)	1 1/2 x 3 1/2 x 4 1/2	1 1/2 x 5 1/2 x 3 1/2	1 1/2 x 5 1/2 x 3 1/2	1 1/2 x 3 1/2 x 4
Width of scanner window (inches)	2 1/2	4	4	2 1/2
INTERFACE				
Addressing scheme	IRQ	DMA	DMA	IRQ
Switchable IRQ	●	N/A	N/A	○
Available IRQ settings	3, 5	N/A	N/A	3
Switchable address	●	○	●	●
No. of addresses available	8	None	4	63
Cable length (inches)	60	72	72	69
SCANNING SOFTWARE				
Software program	Soft Stationary	Halo DPE	Paintshow Plus	GEM Scan
RAM required	384K	512K	256K	512K
Max. length of image scanned (inches)	10	11	11	11
No. of gray scales	3	1	1	3
GRAPHICS FORMATS				
JPG	○	●	○	●
.PCX	●	○	●	○
TIFF	○	●	●	●
.PIC	○	●	○	○

●—Yes ○—No

N/A—Not applicable; this product does not use interrupt requests (IRQs).

words so that the user can listen to the text. Mitsubishi, Commodore, Nisca, and Marq Technology are among the companies that expect to release hand scanners this year as well. Hand scanners, after all, are still in their infancy; you should expect several changes as the market matures.

Are hand scanners really handy tools or just interesting gadgets? Like any other product, it really depends on what you need to get the job done. Make a wish list of those capabilities that you want out of a

scanner, then compare it with what you find in the following reviews. Included are scanners from The Complete PC, Diamond Flower Electric Instrument Co. (DFI), Logitech, Packard Bell, Saba Technologies, and TransImage Corp.; they are arranged alphabetically by company name. Once you've chosen a scanner you like, get a demo from your local dealer and ask hard questions about image editing, file formats, and recognition techniques—before you write the check.

OCR SCANNERS

SABA TECHNOLOGIES INC.

Saba Handscan

When you see Saba Technologies' ads with the Handscan moving a column of numbers effortlessly into a spreadsheet, it triggers feelings of both excitement and skepticism. It looks too easy, you may think, and couldn't possibly support so many fonts. Once you try it, however, the \$799 Handscan dispels your doubts with an impressive performance on fixed-spaced fonts.

The Handscan unit looks like a chubby mouse with a windshield. On the top a square button used to initiate scans is joined by two arrow-shaped buttons on both sides of it. An arm containing the scanning light protrudes from the front of the unit and is surrounded by a clear plastic guide. And a red line is etched in the guide; the Handscan glides on two vertical wheels mounted to it.

To connect the Handscan to your PC, you insert a full-length circuit board in the



FACT FILE



Saba Handscan

Saba Technologies Inc.

9300 SW Gemini Dr.

Beaverton, OR 97005

(503) 626-7050

List Price: \$799

Requires: 512K RAM, two disk drives, DOS 2.1 or later, PC/XT/AT compatible or IBM PS/2 Model 30 (needs full-length expansion slot).

In Short: A well-designed OCR scanner that accurately reads fixed-spaced fonts into most applications. Covers most major brands of mainframe- and PC-based lasers and impact printers. Software not copy protected.

CIRCLE 794 ON READER SERVICE CARD

■ HANDHELD SCANNERS

PC and attach the scanner with a 6-foot cable. The Handscan board requires an unused IRQ and port address, and it comes set up for IRQ3 (COM2). If the board conflicts with your current configuration, you must move the IRQ jumper on the board to another position and, in some cases, change the DIP switches to select another port address.

The scanner software comes on a single disk with a simple installation program. You select the font types to be scanned and enter new addresses if you've changed jumpers or switches. Depending on your selections, the installation program transfers up to 2.4MB of fonts to your scanner directory.

SOFTWARE SETUP To activate the scanner, you run S-DRIVER, a 160K memory-resident program that controls the scanner. You then run SCAN, a program that defines the font that you're scanning

and fine-tunes the scanner's operation. If you switch fonts often, SCAN can be loaded as memory resident; this requires an additional 65K.

The Handscan operates as if you were typing the text from the keyboard. After you've loaded your software, you line up the red line on the plastic guide over the center of the text line and press the center button to activate the scanner. You move the device steadily to the right and release the button at the end of each line. As the scanner completes its conversion, the characters are sent to the screen.

With a good-quality document, the Handscan is rated at 9 characters per second on an XT and 30 characters per second on an AT. As the test document was scanned, the device responded quickly and accurately, even as the red guide wandered off the mark a bit. Too much wandering, however, slowed the recognition of the fonts and quickly reduced the scanning

speed. When the Handscan buffer is almost full, the software issues a low beep so you can pause. If you scan too fast, it beeps at a higher pitch.

Emulating the keyboard in every application presents big problems, but the SCAN program covers all of the bases. All of the Handscan buttons, including both the push and the release of the center button, can be programmed with an extensive keystroke sequence.

FONT SUPPORT Saba markets the Handscan to users that scan computer-generated reports, and the list of supported fonts reflects the company's approach. The device supports several laser fonts for the IBM 3800 and Xerox 9700, and line printer fonts for Data Products and IBM printers. In addition, it supports NLQ fonts for the Epson FX and LQ printers, Okidata 190s, Toshiba, and IBM Proprietary, as well as letter quality printers using a vari-

STOP WAITING ON TABLES.

	1982	1983	1984	1985	
Net sales	\$ 263,537	\$ 277,545	\$ 326,268	\$ 425,654	\$ 48
Expenses	303		313,456	37	
Gross	(39)		112,198	10	
Tax rate	4		45.7%	42	
Taxes	16		(51,274)	(46	
Net income	(\$23,100)	10,502	31,304	\$ 60,924	\$ 62
Earnings	\$ 0.02	\$ 0.32	\$ 0.53	\$ 0.93	\$ 02
Shares	55,211	57,034	58,764	65,465	65

ety of fonts. The Handscan does not support proportional fonts, and it had extreme difficulty interpreting some of our scanner test scripts.

In case you don't know the font you're scanning, the SCAN program's automatic search feature identifies the closest font that matches it. You select the category of fonts to search (lasers, NLQ, and so on) and select Automatic mode. SCAN requests some sample data, and after you scan in some text, it searches its font library for a match. When it finishes, it presents a list of possible fonts with its success rate and lets you select a font.

Saba also included options to further enhance the Handscan's performance. You can instruct the scanner to skip characters, change them to other characters, or start and stop a scanning procedure when a character is sensed. Both the speed of sending characters and the contrast levels are controllable, and you can limit the

character set to numbers only.

In getting started, you'll find the Handscan's documentation excellent from installation to tutorial. The software reference section is detailed, and there are many good tips to help you use the product. The word processing and spreadsheet tutorials are also extensive and helpful.

The Handscan is well designed, with very few drawbacks. The lack of proportional fonts is disappointing, since more and more outputs are created using fonts like Times Roman and Helvetica. With spreadsheets, add-ins, and TSRs already taking up precious memory, the 160K scanner driver may force users to modify their current setup.

Saba has created a dynamite product to bring data quickly and easily from reports to an application. If you spend any time transferring information manually to a PC, the Handscan is an inexpensive yet powerful solution to your problem.

TRANSIMAGE CORP. TransImage 1000

The TransImage 1000 is an OCR camera for serious hand scanning. Working from within your application, the TransImage 1000 lifts a variety of fonts within a range of character sizes and puts them on your screen.

Unlike most handheld optical devices, the \$2,950 TransImage 1000 shakes the mouse image and takes on a more futuristic look. About 2 inches wide, the unit sits on two rollers. On top sit six programmable buttons, and below the unit is the camera that reads the text. At its base, two lights point toward a plastic guide that you pass over the text.

The TransImage 1000 connects to the PC with a 5-foot cable and a monster full-slot board. Besides holding over 700K of memory, this board has five custom VLSI chips and a Motorola 68000 to handle the

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And cook until done.

■ HANDHELD SCANNERS

load. It comes factory-set at address 300H, but you can select up to eight other addresses through the use of DIP switches. In addition, the board uses one DMA channel (1, 2, or 3) and one interrupt (1 through 7),

both set with jumpers.

To set up the TransImage 1000 software, you can either use a batch file or create your own directory and copy the six diskettes to your hard disk. To limit hardware obsolescence, TransImage designed the interface board so that it's loaded from the hard disk each day. In this way, you can make modifications to the system without swapping ROM chips. Using a setup program, the download process takes several stages and, after a few minutes, readies the scanner for its first job.



FACT FILE



TransImage 1000
TransImage Corp.
910 Benicia Ave.
Sunnyvale, CA 94086
(408) 733-4111

List Price: \$2,950

Requires: 384K RAM (512K for optional features), hard disk, DOS 2.0 or later, PC/XT/AT compatible (needs full-length expansion slot); graphics monitor recommended as well.

In Short: A high-priced, high-quality OCR camera that reads most fonts well if you have patience. Includes several tools for streamlining its use in applications. Software not copy protected.

CIRCLE 795 ON READER SERVICE CARD

ware obsolescence, TransImage designed the interface board so that it's loaded from the hard disk each day. In this way, you can make modifications to the system without swapping ROM chips. Using a setup program, the download process takes several stages and, after a few minutes, readies the scanner for its first job.

HIGH-TECH SCANNING To start scanning, you place the plastic guide over the first letter of your text and squeeze the button on the side of the unit. A red light on top flashes, indicating that the scanner is calibrating the camera to the exposure needed. After a short wait the light turns green, which signals you to move the unit across the page. When you finish a line and release the button, the unit processes the text and reads characters directly into your current application. Because of the power of the interface board, the program uses only 12K RAM to transfer characters

DON'T JUST SIT THERE.

Calculating

Spell Checking

Sending

Searching

into the PC's keyboard buffer.

The TransImage 1000 is rated at 40 characters per second and is extremely quick at converting scanned images. Using feature-recognition techniques, the scanner looks for the components that make up a letter—such as the vertical bar and horizontal crossbar in the letter *T*. In this way it can analyze most fonts and sizes ranging from 8 to 14 points. The unit can also learn unusual ones.

To acclimate you to using the scanner, TransImage provides a screen that displays a large image of the scanned letters, helping you see how straight you are scanning. It also takes a while to find the best way to hold the unit, squeeze the side buttons, and still have your index finger in position for pushing one of the programmable buttons.

To enhance the system further, TransImage developed a configuration program with several valuable features. Using a pull-down menu system, you select Modifi-

fy to change the screen colors or the hardware addresses and interrupts. With the Utility option, you can adjust the exposure required for the best scanning, or you can practice scanning a document. The most powerful configuration option, Application, recalls and stores the definition of how the scanner reacts to text.

TOWARD IMPROVED RECOGNITION

A new feature in Version 1.1 of the TransImage software, the Lexical Assist, adds a powerful capability to the system. An optional 150K memory-resident function, the Lexical Assist is a list of 100,000 words that the TransImage scanner uses to solve recognition problems. If a word contains only one scanning error, the Lexical Assist will search for a match.

The TransImage 1000 performed well in our tests, especially in the 10- to 14-point fonts. Errors were most often made in the unusual words (for instance,

QWERTY) or in fonts like Bookman that have flowery *qs* or *gs*. Although the package should handle ligatures and kerning, it had several problems with these, again in the Bookman font.

The TransImage 1000 documentation is a combination tutorial and reference guide, moving step by step through each phase of using the system. In many cases, however, it sends you to a chapter or an appendix that hasn't been covered yet, and you find yourself bouncing around the manual a lot.

TransImage Corp. requires you to take a training class before using the unit—good policy on its part. The configuration software isn't straightforward, and if you're not used to it, it can be frustrating to work with. The first couple of scans are disappointing until you acquire a feel for the unit, but with a couple of hours of training you find yourself moving quickly and accurately across the page.

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The Video Capture is designed for the IBM PC/XT/AT and Models 25/30. It comes with the VC-1000 mechanism, a video digitizer card, RCA video cable, utility disk, user's manual, and the HALO Desktop Publishing Editor package.

FOR INQUIRIES OR TO ORDER, PLEASE CONTACT:

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2544 Port St., West Sacramento, CA 95691, U.S.A. Tel (916) 373-1234 Fax (916) 373-0221

Diamond Flower Electric (Northeast), Inc.

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■ HANDHELD SCANNERS

The TransImage 1000 is a pretty good performer despite its quirks. Fixed-space fonts, however, can be done more cheaply with a unit like Saba's Handscan. And desktop units with good OCR capabilities are coming down in price. If you have a lot of proportional text to scan and you can stick with fonts in the 10- to 14-point range to keep the TransImage 1000's accuracy up, you may be able to justify the cost of the unit.

GRAPHICS SCANNERS

THE COMPLETE PC

The Complete Hand Scanner

To round out its PC-based facsimile transmission product line, The Complete PC offers The Complete Hand Scanner. Used for creating graphics images, this \$249 scanner can be used standalone or teamed up with The Complete PC's PC-based facsimile software.

The scanner's package includes a scanning device, a PC interface board, and *Soft Stationary*, the scanning software. The 3½-by-5-inch scanner features a button on top, plus a small window to help you line up the image. On the left side is a slide switch with four positions: one for black-and-white scanning, the other three for substituting gray scale patterns. An adjustment wheel controls the contrast of the image. And underneath the unit are two rubber rollers: one that signals the distance traveled to the interface, another that keeps the movement of the device in a straight path. A 5-foot cable connects the scanner to an interface card.

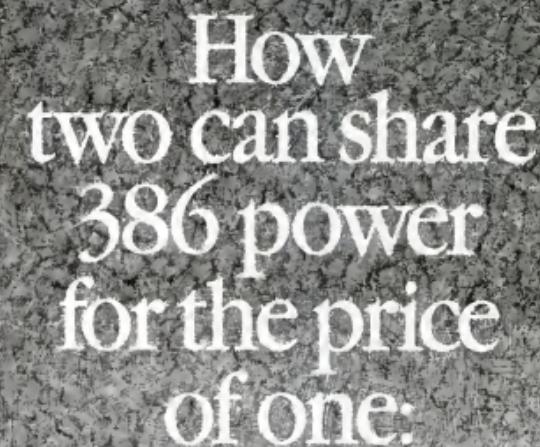
Taking up a short slot in the PC, the card measures a mere 2 inches tall and 4½ inches long. The one DIP switch can be changed to eight different addresses, but the IRQ (interrupt request) is limited to IRQ3 or 5. Since IRQ3 is used by COM2 and IRQ5 by an XT hard disk or an AT bus mouse, you may have to shuffle the configuration of your devices to add the scanner.

The software installation is menu driven and lets you start from scratch, modify the installation, or just install a printer. The

package supports CGA, EGA, or Hercules screens, color, and a mouse. You can also select one of 20 printers and the software's output port.

Although a few questions (such as

printer resolution and bit-per-second rate with LPT1: selected) could be skipped automatically, the rest of the installation is simple and easy to complete. It's a little unnerving, however, to discover that the



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■ HANDHELD SCANNERS

install program adds C:\SCAN to the PATH statement, a device driver to CONFIG.SYS, and a program to the AUTOEXEC batch file without warning.

Once you've completed the installation, the main menu contains six options chosen with either function keys or cursor movements. To scan, you select the menu choice for a 5-inch or 10-inch scan; a row of red LEDs subsequently lights up in the scanner. You then line up the image with horizontal and vertical ridges in the scanner and hold the button down to activate the unit.

As you roll the scanner across the picture, the image appears rapidly on the screen, expanded from the 2½-inch scan area to fill your screen. The unit's two rollers force the scanner to track straight as long as it stays in contact with the object. Just release the button to stop the scanning, and hit any key to turn off the scanner's LEDs and use the editor to manipulate the image.

Once you've scanned the image, you can view and scroll it with the cursor and page keys. The arrow keys scroll the screen slowly; Shift plus an arrow key scrolls faster. You use function keys to re-

duce the image to ¼ or ⅛ of its original size or return it to normal. F5 rotates the image 90 degrees but only to the left, so it's best to scan images that need rotating with the top to the right.

1. Buy this.

PC MAGAZINE FACT FILE



The Complete Hand Scanner
The Complete PC
521 Cottonwood Dr.
Milpitas, CA 95035
(408) 434-0145
List Price: \$249
Requires: 384K RAM, hard disk, DOS 2.1 or later, PC/XT/AT compatible or IBM PS/2 Model 25 or 30 (needs half-size expansion slot); graphics monitor.

In Short: A straightforward handheld graphics scanner that creates images at 200 dpi and converts them to several popular paint-program formats. Software includes routines for merging text and graphics for use in the company's facsimile transmission product. Software not copy protected.

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■ HANDHELD SCANNERS

CLEAN UP YOUR IMAGE The scanner includes two functions to clean up the image. To erase an area, you move your cursor to a starting point, use the cropping function (F6), surround the area with the rectangle that appears, and type F7. You can also save just a portion. The image is saved at 200 dots per inch after you enter a name and select a storage format (from among Z-Soft's *PC Paintbrush*, Microsoft's *Windows Paint*, Media Cybernetics' *Dr. Halo*, and several internal formats).

Soft Stationary offers two tools to merge images and text. The first tool, Convert Images, reads files stored in the formats mentioned above and returns them to *Soft Stationary*'s image file structure. The second can convert a file created by a word processor like *Microsoft Word* or *WordPerfect* and bring it into a format that *Soft Stationary* can understand. To create this file, you print your word processor file to disk as if you were sending it to an Epson printer.

Helping you get started is the scanner's documentation. Although this consists of simply a 108-page tutorial printed sideways and placed in an irritating spiral binding, it covers each of the menu choices well and contains numerous examples. In addition, technical support is helpful.

Keep in mind that *Soft Stationary* has only the basic scanning tools; you'll need a good paint program to really clean up the images. The scanner performs well on signatures and logos, as well as the type of line art that The Complete Fax Board likes, but it's not very impressive in doing gray scales. And the merge and letter features, though handy, are meant only to create documents for the facsimile software.

The Complete PC wanted a tool to add scanned images to its automated facsimile system, and its entry performs the job well. You'll need a few more tools if you plan to use it as a general-purpose scanner, but at \$249, The Complete Hand Scanner makes it possible to afford them.

**DIAMOND FLOWER ELECTRIC
INSTRUMENT CO. USA INC.**

Handy Scanner HS-2000

Diamond Flower Electric Instrument Co. (DFI) produces add-on boards for the PC ranging from simple communications

cards to complicated multifunction boards. Complementing its line is the \$299 Handy Scanner HS-2000, a 4-inch handheld graphics scanner.

When you buy the HS-2000, you get

the scanner, a half-slot interface board manufactured by DFI, a utility disk, and Media Cybernetics' *Halo DPE* (*Desktop Publishing Editor*), a tool for scanning and modifying images. The HS-2000 mea-

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HANDHELD SCANNERS

sures 5 inches in front and slims to a longer, 4-inch area for holding the unit. On the top is a clear, red-tinted viewing window, and a 6-foot cable runs from the back to the interface card in the PC. As you scan, a single roller beneath the unit registers the distance you've travelled.

PROVIDES FEEDBACK When you start a scan, the unit alerts you by turning on the row of red LEDs below. Peering through the view window, you line up the image, depress the side button with your thumb, and slowly pull the scanner over the picture. The scanner reads the image at 200 dpi, and the image appears on the screen when you either hit the Esc key in *Halo DPE* or exceed the length you specified.

The HS-2000 utility software includes a single program called SCAN, several demonstration programs, and several assembly language routines for using the scanner. Although SCAN is limited, it's actually a very well written and handy utility.

On the right of the SCAN screen, you see an uncropped reduced image of the scan. On the left is the actual image. After scanning with the Scan option, you use the View option to look at different areas on the image and select an area for pixel-level changes. The File option saves in *Microsoft Windows*, *GEM*, *Dr. Halo*, and *PC Paintbrush* formats and will rotate the picture 90 degrees if necessary.

To help you do a better job of scanning and cleanup, DFI bundled *Halo DPE* into the package. To set up this sophisticated image-editing tool, you copy the disks to a subdirectory on your hard disk. You then run SETUP and select your screen, printer, mouse, and several global settings.

RELIES ON ICON INTERFACE Unlike most paint programs, *Halo DPE* abandons the pull-down menu choices and relies solely on icons for the user interface. While this method can be intimidating at first if you're unfamiliar with paint programs, it does give *Halo DPE* a simple way of accessing its huge array of features.

Once familiar with these icons, you can manipulate images very quickly. To scan, you merely click on the scan icon and push the left button to start the unit. You then scan the image and hit Esc to display the image. With *Halo DPE*'s virtual page feature, you can click on the directional arrows to move to an area or reduce the image, then select an area and move directly to it without scrolling. With the fat-bit icon, you can select an area, explode it to the pixel level, and clean up the image.

While the 4-inch scanning area is a relief after working around the limits of the 2½-inch scanners, the 4-inch unit was less comfortable to use than the 2½-inch models. With the push button on the left, the side pressure on the unit tended to push it off a straight track to one side. In addition, the long, single roller on the bottom did not resist sideways movement as well as did the double rollers on the 2½-inch model.

The HS-2000 does a good job on line art and an adequate job on halftones. You can rescan pictures quickly until you get the right one, and *Halo DPE*'s ability to move the screen rapidly speeds that process. In some cases, however, images made on printers with resolutions different from the scanner's, such as a 150-dpi and

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Handy Scanner HS-2000
Diamond Flower Electric Instrument Co.,
USA Inc.

2544 Port St.
West Sacramento, CA 95691
(916) 373-1234

List Price: \$299

Requires: 512K RAM, two disk drives,
DOS 2.0 or later. PC/XT/AT compatible or
IBM PS/2 Model 25 or 30 (need half-size ex-
pansion slot); graphics monitor.

In Short: A 4-inch handheld graphics scanner that creates line art and images at 200 dpi. Comes with simple scanner utility and *Halo DPE* desktop publishing software. Software not copy protected.

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The scanner model SP-MF216AF can scan an 8½" x 12" page in 10 seconds, independently or with its optional automatic paperfeeder, model SP-MH01FA, shown above.

CIRCLE 371 ON READER SERVICE CARD

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Actual Size

HANDHELD SCANNERS

300-dpi Hewlett-Packard Series II LaserJet, will not come out the same size as they were scanned, and you'll have to scale them to adjust their size. In addition, *Halo DPE* requires a lot of memory for images created for printers like the LaserJet; without EMS, you may not be able to get larger images into memory.

At the time this article was written, DFI was nearly ready to release the Handy Scanner 3000, a hand scanner with selectable dpi settings of 100, 200, 300, and 400. Able to scan flat objects of any thickness, the HS-3000 will handle images up to 4½ inches wide and 20 inches long. It also will include better gray scales, faster scanning, and several other features. The company is involved in creating an OCR software option for reading proportional and fixed space fonts as well.

The HS-2000 is a good little scanner for entry-level publishers. *Halo DPE* has good capabilities, and both the line art and gray scales are good enough for simple news letters and logos. But if DFI's new unit delivers all that the company has promised, you should take a hard look at that instead.

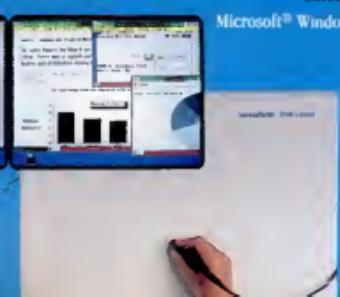
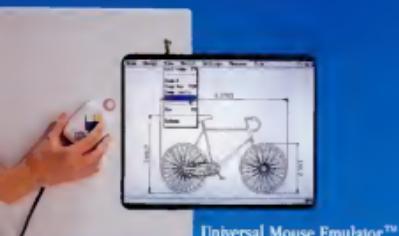
LOGITECH INC. ScanMan

Logitech was first to prove to the world that there is such a thing as a good, inexpensive mouse. Now, after successfully releasing thousands of mice to PC users, the same company has introduced another handheld device: the ScanMan, a \$299 graphics scanner.

The ScanMan package comprises the scanner, a half-slot interface board, and a number of software packages and utilities. Except for the logo and different labels on the switch, the scanner is identical to the one described in the DFI review. Instead of using IRQs, the interface board uses DMA channel 1 or 3, selectable by moving a set of jumpers. The board address is factory set at 280, but you can move a different set of jumpers and select one of three other addresses.

Scanning with the ScanMan is similar to scanning with the DFI unit as well. After you request a scan, you press the side button with your thumb and slowly pull the scanner over the picture. If you go too fast,

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the scanner can't keep up and the image will be compressed or distorted.

NO-FRILLS UTILITIES The ScanMan software installation takes very little time and thought. The simplest way to use ScanMan is with the two utilities that read the image and send it to a file. At the DOS prompt, you enter SCAN2TIF or SCAN2PCX with optional parameters for length and width, and the scanner activates. After you scan, the program converts the image to .TIF or .PCX in a few seconds and creates a file. No frills here—but it's a "quick and dirty" way to store an image if you're comfortable with the scanner settings.

Adding a little gee-whiz to the product, Logitech wrote WINSCAN, a program that runs under *Microsoft Windows*. Although it performs no editing functions, WINSCAN is a slick way to scan an image quickly, review it with the scrolling tools of *Windows*, and either save it or clipboard it for another *Windows* application. A click on "Scan" in the menu bar or Alt-S activates

the scanner.

After scanning, a portion of the image shows up full size on-screen, and the entire image is displayed in a reduced-view window. When you're satisfied with an image, you can print it or save it to a TIFF, .PCX, or .MSP (Microsoft's *Windows Paint*) format. If you prefer, use the mouse to select a portion of the image and clipboard it or save it as a partial image.

The workhorse of the software group is *PaintShow Plus*, a full-featured paint program comparable to many popular ones on the market. A palette of paint tools is displayed to the left of the work area, and both the line-width selector and pattern palette are positioned below it. To start scanning, you select Scan from the pull-down menu bar, then Scan Picture. After the scan, *PaintShow Plus* displays the upper-left-hand corner of the image in the work area.

PaintShow Plus has several tools that help you clean up the image. You move the image on the screen with the flat hand tools and do larger areas of extraneous dots with the eraser tool. Brush, roller, spray can, line, and text tools are useful to overlay your own enhancements on the image. With the Magnify option, *PaintShow Plus* blows up the image and displays the pixel representation of a small part of the image. Using the left button on your mouse, you can add one pixel at a time to enhance the image or, using the right button, eliminate unwanted dots.

The 4-inch scanning area is adequate for many of the pictures that are usually scanned. As noted with the DFI model, the 4-inch unit seemed harder to use than the 2½-inch models. Rectangular pictures, like the *PC Magazine* logo, are very frustrating to scan. Even if you finally get the top line straight after ten passes, make one little blip as you move the unit, and the bottom line is crooked.

GOOD JOB ON LINE ART The ScanMan does a good job on line art, and *PaintShow Plus* cleans up the image well. The software makes it easy to rescan the image several times, so you can pick the best image before you start editing. Halftones, however, are not as sharp, resulting in many disappointing scans.

Logitech's documentation is written in a helpful, no-nonsense way. It gives you

all the facts and examples that you need to start scanning, and it's easy to come up to speed quickly. If you run into problems, there's a hot line and a Logitech-supported bulletin board to help you.

Overall, the ScanMan is a good-news,

PC MAGAZINE EDITOR'S CHOICE

• Many Called, None Chosen.

In the graphics category, not one of the four products reviewed presents any capabilities that distinguish it from the pack. First, handheld graphics scanners are a relatively new addition to the scanner market—the race has barely begun. And without customization they yield excessive maneuverability, limited contrast, and only 200-dpi resolution. In most cases, software included in the package is the same software currently offered with desktop models.

With two OCR scanners aimed at different markets, it's impossible to compare one with the other and select a favorite. Saba's Handscan is a top-notch unit for fixed-space fonts and a good tool for people who constantly move text from mainframe reports to PC applications. The TransImage 1000 is aimed at a more general market: users who are willing to pay the price to scan just about any text. Both do their jobs well in the markets their manufacturers have chosen.

If you can't afford a low-end desktop scanner, the hand scanners designed for graphics do turn out decent line art and adequate grayscale pictures, and it won't cost you an arm and a leg to get one. But combination handheld graphics and text scanners will soon be on the market. Scanners with more than 400-dpi resolution and inexpensive OCR capabilities will soon be commonplace, so it may be a little early to buy at this time.

PC MAGAZINE FACT FILE



ScanMan

Logitech Inc.
6505 Kaiser Dr.
Fremont, CA 94555
(415) 795-8500

List Price: \$299

Requires: 256K RAM, two disk drives, DOS 2.1 or later, PC/XT/AT compatible or IBM PS/2 Model 25 or 30 (needs half-size expansion slot); graphics monitor.

In Short: A simple handheld graphics scanner that creates 4-inch images at 200 dpi in a variety of popular file formats. Package includes three programs for scanning from a paint program, *Microsoft Windows*, or the DOS prompt. Software not copy protected.

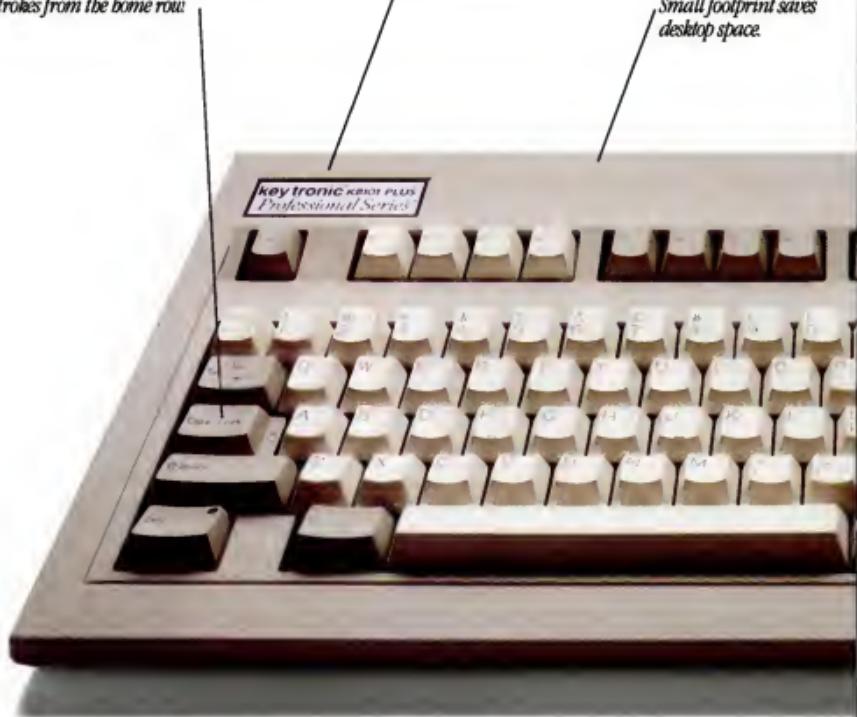
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bad-news proposition. You get some great software and over 4 inches of scanning area. Halftones are weak, though, and you may need to scan several times to get the image right.

PACKARD BELL PB-PS1000 Pocket Scanner

Packard Bell, a familiar name in the electronics industry, is now reselling imported monitors and other PC equipment. The company's latest product, the PS1000 graphics hand scanner, is manufactured in Japan and bundled with some good old American software to make it a handy little product.

The \$349 PB-PS1000 Pocket Scanner includes a scanning device, a PC interface board, and two software packages. The scanner and board are nearly identical to those in The Complete Hand Scanner (also reviewed here) with some minor changes. The DIP switches are factory set at address 280 and IRQ3, and although the address can be changed, IRQ3 must be used. This switch disables COM2, so you may be forced to rearrange the configuration of some devices.

Packard Bell's scanner software package is actually just one program, POCKET.EXE, and you can copy it anywhere on your system. When you execute it the first time, POCKET asks for one of three screen types (CGA, EGA, or Hercules) and the address of the board. From then on, POCKET displays a simple menu from which you can start a scan, save the image in TIFF format, modify the configuration, test the scanner, and exit.

The PS1000 package also includes GEM Scan, a Digital Research scanning product, with a special driver to support the scanner. The installation program, SCANPREP, helps you define your configuration quickly and load your PC with the scanning software. Although GEM Scan usually includes the drivers for several other scanners, the bundled copy supports only the PS1000.

POCKET-SIZE SCANS For simple and quick scans, POCKET is more than adequate. After you select the Scan option from the menu, a row of red LEDs lights

up in the scanner. Looking through the view window, you line up the lights with the image and hold the button down to activate the unit. As you roll the scanner across the picture, the image appears rapidly on the screen—expanded from the 2½-inch scan area to the size of your screen. Just release the button and the LEDs shut off. You can then view the image by using the cursor and page keys to scroll it. To save the image in TIFF format, 200 dpi, just hit Esc and select the Save option.

Most scanned images need to be cropped or cleaned up, and GEM Scan is a handy tool for the task. Much like other GEM products, GEM Scan displays a work window with scroll bars to move your image horizontally and vertically. In addition, pull-down menus help you save files and select options. Since the hand scanner is more limited than a full-size scanner and some of the controls are on the unit, many options, like contrast and brightness, are disabled on the screen.

Before you scan, you can select either


FACT FILE



FACT FILE

BY MIKE FALKNER

PB-PS1000 Pocket Scanner
Packard Bell
21800 Ormond Blvd., #700
Woodland Hills, CA 91367
(818) 716-2727
List Price: \$349
Requires: 512K RAM, two disk drives,
DOS 3.0 or later, PC/XT/AT compatible or
IBM PS/2 Model 25 or 30 (needs half-size
expansion slot), graphics monitor.
In Short: An easy-to-use handheld graphics
scanner that creates TIFF or GEM's .IMG
files from pictures up to 2.5 inches wide.
Bundled with GEM Scan, it's good for scanning
and editing logos and small artwork for
use in desktop publishing packages. Software
not copy protected.

CIRCLE 70 ON READER SERVICE CARD

the halftone or the line-art method of scanning. You click your mouse on START to activate the scanner, then press the button again and pull the unit across the picture. Shortly after you release the button, a reduced version of the image is displayed in the work window. You can expand this image up to eight times its normal size to work on it.

CHANGE IN TOOLS Once GEM Scan has the image, you can select the Edit function from a menu. The program's toolkit then changes to show the special editing tools available. To crop an image, you can move the window frame around it and erase everything inside or outside that frame. You can also flip images horizontally or vertically, rotate them, or reverse all the pixels in the image. In addition, GEM Scan's microscope tools let you zoom in on a section and modify the image one pixel at a time. You can then print the image and save it in either .IMG or TIFF format.

The PS1000 documentation from Packard Bell is only 15 pages long, and skimpy at best. It covers the basics for installation, as well as use of the hardware and POCKET software. The GEM Scan manuals, however, include an installation guide, a tutorial, and a user guide, all well prepared and useful.

At 200-dpi resolution, Packard Bell's PS1000 is good for scanning logos and other line art. For small pictures and art, you'll have to play with the three grayscale settings to get a decent scan, and even then the results are not impressive. When you soon discover that many pictures also exceed the 2½-inch limit, you may look longingly toward a 4-inch model. It's also a shame that the interface board ties up IRQ3, because many scanner users have a myriad of other devices hanging off their PCs. They need that port.

The PS1000 won't replace the desktop scanners for heavy desktop publishing systems. But its \$349 price tag and good editing tools do bring a little more pizzazz within reach of many aspiring small-time publishers.

Mike Falkner is an independent micro-computer consultant based in Sacramento, California.

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Purchasing a modem can be confusing. Here's an overview of how modems work, points to consider when buying one, and insights into the basics of data communications.

Modems have become an integral part of what makes a personal computer productive. Whether they're used to transfer files between distant offices, to access information from on-line commercial services, to avoid the frustrating game of "telephone tag" by sending messages via electronic mail, or to download the programs published in *PC Magazine*, modems are the key to connecting your individual computer, over telephone lines, to a host of others.

Once set up with appropriate software, a modem is designed to be the proverbial "black box," whose internal workings need not concern the user. And since a single company's modems—the Hayes Smartmodem product line—have set a standard for compatibility among PC modems, many people assume that all they have to learn about a modem is how to plug it in and turn it on.

Unfortunately, however, such an attitude makes you completely vulnerable when something *doesn't* work correctly. Connecting with a new on-line service, public-access Bulletin Board Service (BBS), a new office system, or even using a new communications software package can present problems if you don't have at least a basic understanding of what modems do and how changes in their parameters and settings affect how they do it.

In this PC Lab Notes I'll provide a low-level view of how modems operate and of the characteristics of different modems. In addition, I'll discuss some of the basics of data communications and the serial ports through which modems plug into the PC.

DO I NEED A MODEM? Except for very short, directly wired PC-to-PC connections, modems are required for virtually all data communications. To connect your PC with a remote system via the pub-

lic telephone network, you need a modem. While certain very-high-volume corporate operations may justify the expense of dedicated private lines or satellite links, it's almost always more convenient and less expensive to use the regular telephone system to communicate between computers over long distances.

The telephone system, however, was designed to handle analog, not digital, signals. The human speaking voice produces sounds that, over a range of tones and intensities, are continuously variable. The electrical currents in a telephone wire that correspond to (are analogs of) these continuously variable sounds behave very differently from the binary pulses with which computers work. The telephone system must process the analog signals that pass through it with equalizers, filters, and amplifiers, in order to preserve intelligibility over long distances. These processes would make the digital signals produced by a PC unrecognizable. Thus, as illustrated in Figure 1, a device is needed to convert the digital signals generated by a PC into analog signals that can be transmitted over the telephone lines and, at the other end, to reconvert these signals into digital form. This two-way conversion process is known as MODulation-DEModulation, which gives the modem its name.

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PHONE SYSTEM CONSTRAINTS

Specifically, the analog constraints imposed by the telephone system involve such factors as bandwidth limitations, echo suppression, and background noise.

The *bandwidth* of a system is the range

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of frequencies that can be properly transmitted and received through it. The potential data throughput of a transmission medium is proportional to its bandwidth: the greater the number of frequencies supported, the more information the system can carry.

The human hearing mechanism has a bandwidth that spans a frequency range from approximately 20 to 20,000 Hz. When the telephone system was designed, however, considerations both of cost and of available technology dictated a decision to limit its bandwidth to the frequencies between 300 and 3,000 Hz. This range is adequate for intelligible speech transmission, but it is far narrower than what's desirable for contemporary data communica-

tions devices. A wider range of available frequencies would have made high-speed data transmission infinitely easier; without it, modem manufacturers instead have had to develop complex modulation methods to get around the telephone lines' bandwidth limitation.

The need for echo suppression constitutes a second constraint imposed on successful data communications through the telephone system. While you're generating signals by speaking into the telephone, any signals received at your end are eliminated using echo suppressors or filters. When you stop talking, the phone system senses the change and switches the echo filter to work in the opposite direction. This effectively limits telephone signal

transmission so that only one voice (or signal) is transmitted in one direction at a time. In serial communications jargon, this is known as *half-duplex* operation: signals can travel in both directions, but in only one direction at a time. (See the sidebar "Data Communications Overview" for a fuller discussion of this and related terms.) While you don't normally notice the change in direction during a telephone conversation (it's very fast from the point of view of the human ear), the switchover creates a significant delay for data communications devices.

A modem can disable the telephone system's echo filtering by transmitting a 2,100-Hz tone at certain intervals. However, older echo filters (those built in the

DATA COMMUNICATIONS OVERVIEW

Technically, the phrase *data communications* involves any transfer of data from one source to another, whether from disk to memory, from PC to modem, or from PC to PC. Most commonly, however, it refers to data transfers between remote computers connected through the public telephone system.

Whenever data is transferred from one PC or device to another, each individual character or byte is broken down into its individual component binary digits, or bits. These bits, a series of 0's and 1's, can be transferred in either a *serial* or *parallel* fashion. Internally, the PC moves data in a parallel manner; all 8 bits of each character are transferred at the same time over the PC's data bus, which has a separate path for each bit.

Parallel data communications, used by many printers, work the same way: a character is transferred via a cable that has a wire for each of the bits in a character, so the entire character can be sent through the cable at the same time. However, parallel data communications are not practical over long distances (more than 100 feet) and are incompatible with the telephone system.

In serial data communications, the PC's asynchronous communications adapter breaks down each character into

individual data bits and sends them sequentially, one after another. Although not as efficient as parallel data transfers, serial transfer techniques are required by the telephone system: voice communication technology does not use parallel signal paths. Had modern data communications developed before voice communications, long-distance parallel data transfer might be in use today. AT&T's ISDN (Integrated Service Digital Network) system will eventually allow virtually any kind of signal (including voice,

data, and video signals) to be transmitted digitally over the same lines.

SERIAL DATA CONFIGURATIONS

Serial data can flow in three ways: *simplex*, *half-duplex*, and *full-duplex*. Simplex transmission allows data to flow in one direction. Half-duplex allows data to flow in either direction, but in only one direction at a time (it is actually an implementation of simplex in both directions). Full-duplex, also known as duplex, allows data to be transmitted in either direction simultaneously. This last method allows communicating devices to have complete and independent transmit and

Anatomy of a Data Transfer

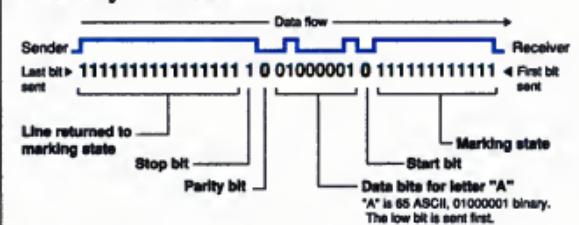


Figure A: This diagram shows the flow of bits required to transmit the letter "A" over a typical modem setup. Now read the diagram right to left, starting with the first bit sent. Note that the data line begins in a marking state of all 1's, followed by the start bit, data bits, parity bit, and stop bit, then returns to a marking state. Spaces between bits are for illustrative purposes only.

Conversion and Modulation/Demodulation

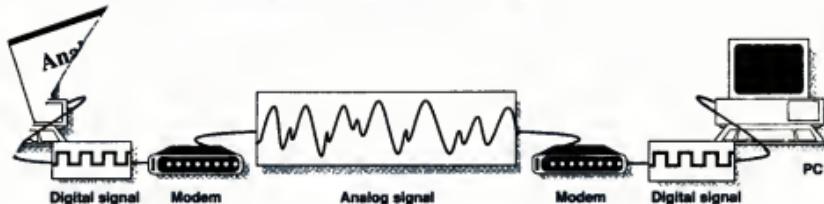


Figure 1: At the transmitting end, a modem's purpose is to convert the digital (shown here as a square wave) signal generated by a PC into an analog signal that can be sent over ordinary telephone lines, a process known as modulation. The analog signal is reconverted to digital form by another modem at the receiving end, a process known as demodulation. The ability to MODulate/DEModulate a signal gives the modem its name.

receive capabilities. The most efficient high-speed modems attempt to communicate using full-duplex.

Since all the bits in a character are sent simultaneously in a parallel data transfer, it's relatively easy for the receiver to reassemble the character at the other end. Reassembly presents a problem for serial transmission, however, for without proper identification of where one character ends and another begins, the signal becomes nothing more than a meaningless stream of bits. To prevent this, a number of rules and conventions, known as *data link controls*, have been established that govern the signals transmitted between two communicating stations.

By using data link controls, the hardware at both ends of a communications link can synchronize the bits transmitted serially from one station so that they are properly recognized as they are encountered by the receiving station. This is done by sending additional bits, characters, and messages along with the data as it is sent from one station to another. These bits are added by the communications hardware and software on the transmitting side, are deleted on the receiving side, and remain hidden from the user.

Both synchronous and asynchronous data link controls are available for synchronizing serial data transmissions. Synchronous data control is the basis for mainframe protocols such as BSC (bi-

sync), SDLC (Synchronous Data Link Control), and HDLC (High-Level Data Link Control). Asynchronous data control is the most popular method for synchronizing serial data transfers on PCs.

In asynchronous data transmission the sending and receiving stations do not share a common, synchronized time base. Data transfer can be commenced at any point in time and is not part of a continuous, coordinated stream. Each set of data bits that constitutes a single character must include a preceding and trailing set of synchronization bits, known as start and stop bits; thus this technique is also known as the start-stop control method. The receiving station must be able to individually recognize the start bit, data bits, and the stop bit that follows them. Since the process allows resynchronization as each character is transmitted, it tolerates minor timing differences between the sender and the receiver.

The way in which a single character is transmitted asynchronously is shown in Figure A. The communications line is first set to a marking state, represented by a stream of binary 1's. Thus the reception of the start bit—a binary 0—presents a clear, obvious change. The start bit signals the receiver that a character is being transmitted and that the data bits will subsequently follow. While faulty start bits can be generated, they can normally be detected and filtered out by the asynchro-

nous communications hardware.

Since asynchronous communications is based on intermittent transmission, each character can be individually checked for errors. This is done by adding an additional parity bit following the data bits that make up the character. The value (1 or 0) of the parity bit depends on which of several error-detecting schemes (odd, even, mark, or no parity) is being used by the modems at each end of the communications link. Line noise can sometimes garble a character so that a simple parity bit system can't detect it. However, a communications protocol can catch these kinds of hidden errors.

After the start bit has been received, the receiving station must count the data bits and optional parity bit. These are followed by one or more stop bits or binary 1's, which also return the data line to a marking state after telling the receiving device that an entire character has been transmitted. ASCII text can be transmitted with only 7 bits, so the 8th bit in a conventional byte is available for use as a parity bit. Executable files (files with .COM and .EXE extensions, for example) require a full 8 bits per character. The sending and receiving modems must be set to agree on the number of start, data, parity, and stop bits that together will make up an individual character unit, or the synchronization will fail.

—Richard Hale Shaw

■ PC LAB NOTES

1960s and earlier) do not always obey the disabling signal. When the phone companies' own echo-suppression filters don't respond correctly, the modems at each end may have to take over the echo-cancellation process and do the job internally. This becomes an increasingly severe problem for modems designed to transmit and receive at speeds above 1,200 bits per second (bps).

General background noise on the telephone line presents another problem. Since the strength of the transmitted signal can drop significantly by the time it reaches the destination, the remote modem may find it hard to separate the received signal from the normal line noise. Again, the faster the modem operates, the more difficult this becomes. Hardware that could screen out telephone line noise at high modem speeds (4,800 to 9,600 bps) had been developed, but it did not become practical until 1984. And it was nearly 2 years after that that modems using it became available. The cost of high-speed modems will remain relatively high until these development costs can be written off and until greater numbers of modem manufacturers enter the high-speed modem marketplace.

CLASSES OF MODEMS Modems are generally classified according to their speed and features. A modem's speed is defined as the fastest rate at which it can transmit or receive data, and it is measured in bits per second. In other words, modem speed is determined by the number of binary 1's and 0's that can be transferred per second.

Bps is often confused with the term *baud*, which refers to the number of changes that the modem's analog carrier signal undergoes per second. At speeds below 600 bps, the two terms are virtually synonymous, which started the confusion. At higher speeds, however, modems often gain transmission throughput by changing their carrier state in such a way that it can represent more than a single digital bit. Since what's important is not how the analog signal is manipulated, but the number of digital bits that go into the transmitting modem and emerge from the receiving modem, it's best to specify modem speed in terms of bps.

LOW-SPEED MODEMS Low-speed modems transmit data at speeds of up to 600 bps. While low-speed models such as the Hayes Smartmodem 300 were popular with PC users in the early eighties, they have generally given way in recent years to faster, less expensive units. I mention them here for historical reasons; there are few reasons, economic or otherwise, to consider purchasing them today.

The low-end models had few of the features that are more-or-less standard today, such as auto-dial and auto-answer capabilities. The modem that initiated the connection was set (usually manually) to "originate" mode, and the responding remote modem was set to "answer" mode. Sender and receiver used separate pairs of frequencies for transmitting binary 1's and 0's, so four frequencies were required. Since data transmission involved shifting between the frequencies, the process was called frequency-shift keying, which was a relatively slow but stable technique.

MEDIUM-SPEED MODEMS Modems that operate in the 1,200- to 2,400-bps range are considered medium-speed modems, and these dominate the PC market today. In addition to providing auto-dial and auto-answer facilities, many of these models will even store phone numbers for you. (Other modem features are discussed in greater detail below.) Instead of shifting between specific frequencies, 1,200-bps modems use the more advanced techniques of phase and amplitude modulation to transfer data; the method is known as phase-shift keying. This permits them to create more bit patterns per carrier change than did low-speed modems. By handling two digital bits per baud, a 600-baud carrier achieves a throughput of 1,200 bps. The 2,400-bps modems, on the other hand, use a different variety of phase and amplitude modulation that results in 16 possible carrier states, which can represent all possible values of 4 digital bits. Using the same 600-baud rate to handle 4 digital bits results in transmitting 2,400 bps.

HIGH-SPEED MODEMS High-speed modems are relatively new (they began appearing in 1986), and they have raised the transmission capabilities of voice-grade telephone lines into the 4,800- to 9,600-

bps range (and even earlier, one of the key high-speed modems was based on hardware that allows telephone-line echo-cancellation). High-speed modems support speeds at 2,400, 4,800, and 9,600 bps above and are generally based on internationally recognized (CCITT) technical specification called V.32.

The V.32 specification defines a family of *full-duplex* (see the sidebar "Data Communications Overview") modems that can be used with voice, switched, or leased telephone lines. It requires utilization of still more sophisticated modulation techniques that result in the transmission of 5 digital bits for each carrier change at a 2,400-baud rate. While this produces a raw bit throughput of 12,000 bps, 1 out of the 5 bits is used for error correction, which thus reduces data throughput to 9,600 bps. Unfortunately, the echo-cancellation requirements of the specification are still expensive and difficult to implement. While hardware modifications have helped, V.32 9,600-bps modems are not likely to become widespread until the commercial telephone echo cancellers are upgraded.

Rather than wait for the phone companies, however, some vendors have developed proprietary techniques for communicating at very high speeds while bypassing some of the constraints imposed by the V.32 specification. The TrailBlazer modem from Telebit, for example, uses advanced throughput techniques that allow it to realize a speed of 18,000 bps over regular dial-up lines. This is accomplished by dividing the telephone bandwidth into 400-500 carrier signals instead of 1 or 2, allowing it to transfer far more bits per signal than would otherwise be possible. By default, the Telebit TrailBlazer first attempts to communicate at 9,600 bps; if unsuccessful, it automatically switches down 100 bps at a time until it finds a successful transfer rate.

KEY MODEM FEATURES One key feature of today's recently designed modems is known as its *register set*. Older modems used physical switches (DIP, or dual in-line plug, switches) to set their user-selectable operating parameters. To



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PRODUCTIVITY

Smartmodem S-Register Set

Register	Description	Units	Range	Default
S0	Select ring to answer on	Rings	0-255	0
S1	Ring count (incremented with each ring)	Rings	0-255	0
S2	Escape-sequence character	ASCII	0-127	43(+)
S3	Carrige-return character	ASCII	0-127	13
S4	Line-feed character	ASCII	0-127	10
S5	Backspace character	ASCII	0-32,127	8
S6	Wait-time before blind dialing	Seconds	2-255	2
S7	Wait-time for carrier/dial tone	Seconds	1-255	30
S8	Length of pause for comma in number	Seconds	0-255	2
S9	Carrier-detect response time	.1 second	1-255	6
S10	Delay between carrier loss/hangup	.1 second	1255	7/14
S11	Duration/spacing of DTMF tones	.001 second	50-255	70/195
S12	Escape-sequence guard time	.02 second	20-255	50
S16	Test mode			

Register	Description	Units	Range	Default
S18	Select test timer	Seconds	0-255	0
S25	Data terminal ready change detect time	.01 second	0-255	5
S26	Select RTS to CTS delay	.01 second	0-255	1

have been in use for some time, incorporating error-detection and error-correction methods into modem hardware and firmware is relatively new. Hardware-based protocols can achieve a higher throughput, improving the overall rate of data transfer.

One of the more popular of these hardware-based error-checking protocols is the Microcom Networking Protocol, known as MNP. Although it must be built into the modems at both ends of the communications link in order to work, MNP allows modem-to-modem transmissions that achieve 99 percent error-free transmissions, with little additional overhead. This is accomplished by automatically resending erroneous data until it has been properly transmitted. Many MNP-equipped modems automatically sense each other's presence at connection time and transparently begin implementing the protocol without any user intervention.

In addition to its error-correcting facilities, MNP provides efficiency benefits in data transfer. As explained more fully in the sidebar "Data Communications Overview," most asynchronous data transfers prepare a character for transmission by framing it into a packet that usually consists of 10 bits. MNP converts asynch-

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rates the data signal from the additional line noise generated in high-speed communications.

INTERNAL VS. EXTERNAL Although originally available only in low, flat metal boxes that fit conveniently under a standard office telephone, today's external modems vary considerably in size and shape. Most external modems feature the useful (and reassuring) indicator and status lights that are shown in Figure 3. They often require the use of a power supply and must be transported separately from the PC if you take the system anywhere.

Because they are separate from the computer itself, however, external modems can be disconnected and used on another system at any time. While they occupy some additional space, they don't require a card slot inside the machine, as do internal modems. An external modem can be used with virtually any system that has an RS-232 connection on an asynchronous adapter that supports the same speeds as the modem.

Internal modems are actually a full module mounted on an expansion card. They're designed to reside more or less permanently inside your machine. Although they don't require any desk space, they do use up an expansion slot in your PC and can't be conveniently moved to another system without opening up your computer, pulling the modem out, and possibly reconfiguring both the target machine and the modem. Further, internal modems will work only with the type of machine for which they're designed: while you can use an external modem with either a PC compatible or a PS/2, internal modems designed for either machine will not fit in the adapter slots of the other. Moreover, internal modems do not have indicator lights.

However, internal modems do not require an additional power supply (they're powered by your PC), and they usually have a telephone jack built into them. They also eliminate the need for an RS-232 cable. Since they reside inside your computer, they go where it goes.

RECOMMENDATIONS As in all PC-related purchases, what you should buy must depend on what you're trying to ac-

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PRODUCTIVITY

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Smartmodem Indicator Lights



High speed—When this light is on, the modem is operating at its maximum speed. If you're using a 2,400-bps modem, the light will go out if you switch to 1,200 bps.

Auto-answer—This indicator shows the status of the modem's auto-answer mode. When the light is on, the modem is set to answer incoming calls automatically, and the light will briefly turn off during each ring of the telephone. When auto-answer mode is off, the indicator flashes on only during each ring of the phone, and the modem will not answer the phone without a command.

Carrier detect—When lit, this indicator shows that a carrier signal from a remote modem is present. The light will go off if the carrier signal is lost or if the remote modem hangs up. A carrier signal must be present for data transmission to proceed.

Off-hook—This light goes on when the modem is actually using the phone line, that is, when the phone is effectively off-hook.

Receive data—As data is received from a remote system, this light goes on. It also lights up whenever you or your communications software send commands to the modem and echo is on (full-duplex) and whenever result codes are returned by the modem.

Send data—When lit, this light indicates that the modem is sending data to the remote system; it also lights whenever you issue a command to the modem.

Terminal ready—When lit, this light shows that your PC (the terminal) is ready to receive and send data and that the modem is communicating with it. The terminal must be ready in order for your modem to maintain the connection with a remote modem.

Modem ready—This light indicates simply that the modem is powered up and ready to send and receive data.

The majority of Hayes-compatible modems have indicator lights like those above. Some manufacturers have added extra indications (blinking lights), and others have found it useful to add new lights altogether. Additional lights may include

Test mode—The indicator lights up when the modem is in test mode.

Modem check—The meanings for this indicator vary with the test mode.

Figure 3: Most external modems have a series of front-panel indicator lights that display the modem's status and identify the actions it is taking. The usual cryptic labels and some additional indicators are explained in the figure above.

complish. As an overall recommendation, however, I suggest that you think very hard before investing in the now-obsolete technology of a 300-bps modem. Even for simple file transfers, if you compare the

vastly improved throughput of medium-speed modems, the initial savings gained by purchasing a low-speed unit is meaningless. For that matter, the price difference between 1,200- and 2,400-bps mo-

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■ PC LAB NOTES

dems has also dropped to the point where, if your modem is going to get regular use, you should probably opt for a 2,400-bps model.

Although its implementation in medium-speed systems unfortunately is far from universal, if you are planning to transfer a lot of files to systems that do offer hardware-based error protection such as MNP, you should certainly plan to take advantage of it. MNP is very effective in eliminating errors in transfers and will save you time and money spent in re-transmitting files.

Considering a 4,800- or 9,600-bps modem may be a different story, even if your modem is going to get heavy use. For one thing, commercial on-line services are usually slow to upgrade to the latest high-speed technology, though many public-access BBSs make it a point of pride to do so as quickly as possible. Moreover, since a number of modem manufacturers have developed proprietary and independent means of implementing the V.32 high-speed specification, the high-speed modem purchased from one manufacturer often will not work with a modem made by another. So, unless you know you will be using a specific make of high-speed modem to communicate with another of the same make, it may not be worthwhile to purchase a 9,600-bps modem.

Finally, new additions in the modem marketplace include internal modems for laptop PCs and pocket-modems. Modems for the most popular laptop computers are now offered in both 1,200- and 2,400-bps versions. If you need a laptop computer in the first place, the odds are that at some point you'll want to be able to upload and download files or access information services from a remote location, and you can't beat the convenience of an internal modem in your laptop PC. Pocket-modems are an on-the-go alternative. The size of a pack of cigarettes, these small external modems can be used with either laptop or desktop machines. While neither of these new types of modems offers quite as many features as conventional internal or external modems, they're wonderful when portability counts.

The easiest decision to make about modems is that you need to purchase one. But as communications technology advances,

the choice of which modem to buy is becoming more and more complicated. Consider carefully your current requirements and plan with an eye to the future. Armed with the basic knowledge presented in this

article, you'll be able to make an informed buying decision.

Richard Hale Shaw is a contributing editor of PC Magazine.

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■ UTILITIES ■ MICHAEL J. MEFFORD

CHOOSE CONFIG.SYS OPTIONS AT BOOT

Changing system configurations by editing CONFIG.SYS and rebooting is inconvenient at best. But with CONFIG.CTL, you can keep your options open and change them at boot time.

AUTOEXEC.BAT and CONFIG.SYS are probably the first two files a new PC user learns to create. Both allow you to specify commands that personalize your system at boot time. But while the AUTOEXEC.BAT file contains ordinary commands that can be run just as easily at the command line, the CONFIG.SYS file contains statements that are only valid at boot time. So there's no convenient way to change them. You have to boot the machine, modify CONFIG.SYS, and then reboot in order to install the new configuration.

Some PC users will never have to change their CONFIG.SYS files. Eventually, however, most of you will be given a reason to do so. If you haven't installed ANSI.SYS, someone's bound to ask you to run a batch file that requires this driver's control over the screen and keyboard. If you've installed a large RAMdisk, you'll eventually load a big application that stops you cold with an "Out of memory" message. Or you'll find that the Microsoft Windows/386 control program won't run with the IBMCACHE device driver installed.

Of course, the best time to modify the configuration is while the machine is booting up in the first place. CONFIG.CTL lets you do just this. It's a special device driver that enables you to modify your CONFIG.SYS configuration dynamically, right during the boot.

The easiest way to get a copy of CONFIG.CTL is to download it from PC MagNet, as explained in the sidebar "CONFIG by Modem." If you prefer to type in the

code, both the source code (CONFIG.ASM) and an alternative BASIC program (CONFIG.BAS) are listed here as well as available via PC MagNet. Run CONFIG.BAS once in BASIC to automatically create CONFIG.CTL.

USING CONFIG.CTL. In order to use CONFIG.CTL, you must add two lines to your CONFIG.SYS file. Place the first line before the first configuration command you want to be able to modify; place the second after the last configuration parameter you want to be able to change. The syntax is

```
DEVICE=[path]CONFIG.CTL m
[Configuration
  entries to be
  controlled]
DEVICE=CONFIG.END
```

Variable *m* is the number of seconds you want CONFIG.CTL to wait for you to enter a keystroke. (To begin with, I suggest you set *m* at 10.) Any keystroke (except Esc) entered during the *m*-second pause signals that you want to change the CONFIG.SYS file before it loads. If you don't press a key during this period (or if you hit Esc to bypass CONFIG.CTL), your machine will boot up with your regular CONFIG.SYS values.

If you don't supply a number, *m* defaults to zero (0), or no pause. If you need to modify CONFIG.SYS only occasionally, the no-pause default will keep you from being bothered with CONFIG.CTL's opening prompt. Then on those rare occasions when you do want to modify CONFIG.SYS, you can catch CONFIG.CTL's

attention by hitting a key immediately after you hear the booting beep.

CONFIG.END is a dummy device. It doesn't actually exist, so when DOS tries to load it you'll get the harmless message "Unrecognized command in config.sys." It serves, however, as a necessary end of the buffer signature, without which CONFIG.CTL won't operate. Figures 1 and 2 show a typical CONFIG.SYS file before and after it was modified to work with CONFIG.CTL.

With these two lines added to your CONFIG.SYS file, and *m* as a value greater than zero (0), CONFIG.CTL will prompt you each time you boot to press a

```
DEVICE=CLKDRV.SYS
DEVICE=ANSI.SYS
BUFFERS=28
FILES=28
```

Figure 1: A typical CONFIG.SYS file before CONFIG.CTL is added. The CLKDRV.SYS clock driver may either be named differently or may not be needed by your system.

```
DEVICE=CLKDRV.SYS
DEVICE=CONFIG.CTL
DEVICE=ANSI.SYS
BUFFERS=28
FILES=28
DEVICE=CONFIG.END
```

Figure 2: The same CONFIG.SYS file shown in Figure 1 after adding CONFIG.CTL, and the dummy device, CONFIG.END. Since the clock driver should never be omitted for this system, CONFIG.CTL is placed after that line in CONFIG.SYS.



■ UTILITIES

key if you want to modify your CONFIG.SYS file. If you press a key to request CONFIG.CTL's aid, all the commands between CONFIG.CTL and CONFIG.END will appear in a point-and-shoot menu with a highlight bar on the first command, as shown in Figure 3. You can control the position of the highlight bar with the Up and Down Arrow keys. PgUp and PgDn take you immediately to the first and last command, respectively.

You can deactivate a highlighted command by pressing F1. CONFIG.CTL responds by replacing the name of the command to the left of the equals sign with the word INACTIVE. F1 is a toggle key, so a second press will reactivate the command. Once you have made the desired modifications, pressing F2 exits CONFIG.CTL and boots up the system with the new configuration in effect. While at the CONFIG.CTL menu, you can abort any changes you may have made and boot normally, by pressing Esc. Note that no changes are ever made to the actual CON-

```
CONFIG.CTL 1.0 (C) 1988 Ziff Communications Co.
PC Magazine ■ Michael J. Mefford

Press F1 to toggle active state of highlighted command
You may optionally edit a highlighted command.
Press F2 to accept changes and exit.
Press Esc to abort changes and exit.
Note: Permanent changes are not made to the CONFIG.SYS file.

DEVICE      = ANSI1.SYS-
DEVICE      = THIS IS A PLACE SAVER FOR FUTURE DRIVER
BREAK       = OFF
BUFFERS     = 28
COUNTRY     = 001
FCBS        = 004,008
FILES        = 008
LASTDRIVE   = Z
STACKS      = 009,128
```

Figure 3: A CONFIG.SYS file with all the DOS 3.x commands and their default values. Leading zeros are used for some of the smaller values so that larger values can be inserted at boot time.

```
; CONFIG.CTL - Allows you to dynamically change your CONFIG.SYS ;
; file during bootup. To use this, type CONFIG.CTL at the DOS prompt.
; To issue CONFIG.CTL just ahead of the first command you wish
; to be able to modify, a line resembling CONFIG.CTL will precede
; the command. This line is used to identify the command to serve.
; Add DEVICE = CONFIG.EDB after the last command you wish to be
; able to modify. CONFIG.EDB is a dummy device and must appear
; at least once in the CONFIG.SYS file. It is used to
; initialize memory 2.8 or later. Remember to EXIT/REBOOT
; CONFIG.CTL 1.0 (C) 1988 Ziff Communications Co.
```

```
TEXT         SEGMENT PUBLIC 'CODE'
ASSUME CS:CODE, DS:DATA, SS:STACK
ASSUME DS:[TEXT], SS:[TEXT]
ORG 0000H
```

```
***** DEVICE_HEADER *****
```

```
POINTER    DB      -1
REFERENCE  DB      0000000000000000
DEVICE      DB      STRATEGY
DEVICE_CFT  DB      INTERRUPT
DEVICE_NAME DB      "CONFIGURE"
DEVICE_TYPE DB      13
```

```
CS          DB      13
DS          DB      15
CWGL_R     DB      26
SPLT_R     DB      23
COM_R      DB      44
PROMISE_R  DB      47
REGS       DB      256
```

```
-----
```

```
REQUEST_HEADER STRUCT
```

```
HEADER_LENGTH DB      ?
```

```
DEVCNT_CODE DB      ?
```

```
DEVCNT_CODE DB      ?
```

```
STATUS      DB      ?
```

```
REGISTERED DB      ?
```

```
-----
```

```
REQUEST_HEADER ENDS
```

```
DATA        DB      0000000000000000
```

```
MESSAGE    DB      1000000000000000H
```

```
-----
```

```
INIT      DB      0000
```

```
-----
```

```
HEADER    DB      [TYPE REQUEST_HEADER] DUP(?)
```

```
DEVCNT_CODE DB      ?
```

```
DEVCNT_CODE DB      ?
```

```
STATUS      DB      ?
```

```
REGISTERED DB      ?
```

```
-----
```

```
INIT      ENDN
```

```
REQUEST_OFFSET DW      ?
```

```
REQUEST_EDB DW      ?
```

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PRODUCTIVITY

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PRODUCTIVITY

■ UTILITIES

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; All registers destroyed.          ; PROC NAME
DECPLAY      PROC  NEAR
    MOV    SI,OFFSET_DATA_STORAGE ;Point to data storage.
    MOV    DI,NEW_STRT             ;Point to first display row.
    MOV    DI,NEW_STRT
    CALL   EK_CURSOR               ;Set cursor position.
    CMP    COMMAND[SI],LAST_RECORD ;Is it the last record?
    JNE    DISPLAY_End             ;If no, done.
    CALL   EK_CURSOR               ;Else, point to command.
    MOV    AL,""
    MOV    DI,STCR                ;Add quotes and a space.
    CALL   WRITE_TTY
    MOV    DI,10H
    INC    DI
    MOV    DI,NEW_STRT             ;Point to command string.
    NEW    CX,STRNG_LENGTH[SI]     ;Retrieve the string length.
    CALL   EK_CURSOR               ;Display the command.
    MOV    DI,NEW_STRT             ;Point to next record.
    LOOP   NEW_RECORD             ;Next cursor row.
    INC    DI,2H
    CMP    DI,ESIZE
    JNS    DECPLAY
    RET

NEXT_ASSIGNMENT PROC  NEAR
    CALL   EK_CURSOR               ;Set cursor position.
    LOOP   NEW_ASSIGNMENT         ;Loop until end of assignment.
    NEW    DI,TYP_DATE_RECORD     ;Point to next record.
    INC    DI,2H
    CMP    DI,ESIZE
    JNS    NEXT_ASSIGNMENT
    RET

DISPLAY_End  PROC  NEAR
    MOV    DI,NEW_STRT             ;Point to first display row.
    CALL   EK_CURSOR               ;Set cursor position.
    MOV    DI,COMMAND[SI]           ;Command string.
    CALL   EK_CURSOR               ;Point to appropriate command.
    NEW    CX,COMMAND_SIZE        ;Command string length.
    CALL   EK_CURSOR               ;Display command.

FIND_COMMAND PROC  NEAR
    NEW    CX,COMMAND_SIZE        ;Command string length.
    LOOP   FIND_COMMAND
    RET

FOUND_COMMAND PROC  NEAR
    NEW    CX,COMMAND_SIZE        ;Command string length.
    CALL   EK_CURSOR               ;Display command.

DISPLAY_CMD  PROC  NEAR
    NEW    CX,COMMAND_SIZE        ;Command string length.
    CALL   EK_CURSOR               ;Display command.

    RET

DECODE      PROC  NEAR
    NEW    CX,COMMAND_SIZE        ;Command string length.
    CALL   EK_CURSOR               ;Point to appropriate command.
    NEW    CX,COMMAND_SIZE        ;Command string length.
    CALL   EK_CURSOR               ;Display command.

    RET

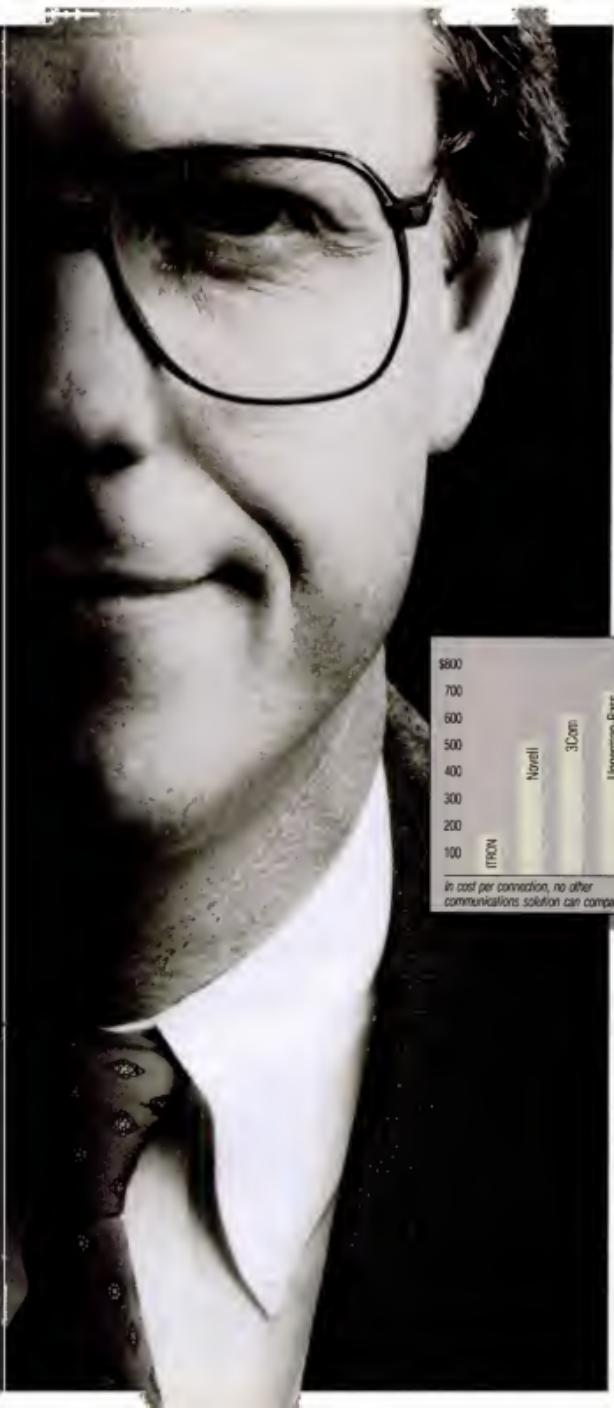
DECODE      ENDP

    ;-----+
    ;|       Carry flag = 0 if good edit. |
    ;|       Carry flag = 1 if edit abort. |
    ;|       All registers destroyed.      |
    ;-----+
    ; All registers destroyed.          ; PROC NAME
EDIT       PROC  NEAR
    MOV    SI,OFFSET_DATA_STORAGE ;Point to data storage.
    MOV    DI,NEW_STRT             ;Point to first row.
    MOV    DI,NEW_STRT
    CALL   EK_HIGHLIGHT_NBR        ;Highlight the first command.
    MOV    DI,NEW_STRT             ;Return with DI = 1; first char.

    CALL   GET_NBR
    CMP    AH,1FH
    JE    EDIT_NBR_SET             ;Set a breakpoint.
    MOV    AH,4CH
    JE    EDIT_NBR_SET             ;Yes, edit with no change.
    CMP    AH,77H
    JE    EDIT_NBR_SET             ;Yes, edit with changes.
    JP    EDIT_NBR_SET             ;Jump to breakpoint.
    AL,0B
    JC    FUNCTION
    AL,0C
    JC    FUNCTION
    AL,0D
    JC    FUNCTION
    AL,0E
    JC    FUNCTION
    AL,0F
    JC    FUNCTION
    AL,10H
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    JC    FUNCTION
    AL,9EH
    JC    FUNCTION
    AL,9FH
    JC    FUNCTION
    AL,00H
    JC    EJECT_NBR_KEY
    RET

    ;-----+
    ;|       The following are the active selection, arms and backspace key procedures. |
    ;-----+
KEY        PROC  NEAR
    PUSH   SI
    POP    DI
    ; Preserve of and DI.
    ;-----+
    ;|       The following are the active selection, arms and backspace key procedures. |
    ;-----+
    ;|       The following are the active selection, arms and backspace key procedures. |
    ;-----+
PI        PROC  NEAR
    PUSH   SI
    POP    DI
    ; Preserve of and DI.
    ;-----+
    ;|       The following are the active selection, arms and backspace key procedures. |
    ;-----+
    ;|       The following are the active selection, arms and backspace key procedures. |
    ;-----+

```



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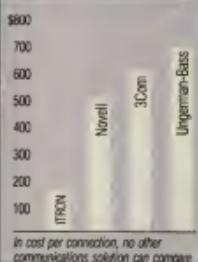
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■ UTILITIES

FIG.SYS file. Dynamic reconfiguration is lost when you turn off the machine and must be chosen again (if desired) the next time you boot.

For example, suppose you have VDISK.SYS in your CONFIG.SYS file and you want to bring the system up without it. At boot time, press a key to get CONFIG.CTL's attention. When the menu appears, you move the highlight to VDISK.SYS, press F1 to deactivate it, and hit F2 to accept the change and exit. It's as simple as that. Disabling any command elicits the same response from DOS as does the dummy device CONFIG.END—namely, informing you that an "unrecognized command" was found in CONFIG.SYS. Just ignore the error message.

CONFIG.CTL also allows you—with limits—to edit CONFIG.SYS commands. For example, you can change BUFFERS from 20 to 2 by highlighting the 20 and typing the new value. The Home and End keys take the cursor to the beginning and end of a highlighted command you're editing. CONFIG.CTL is not a full-fledged editor; it operates only in

overwrite mode and you can't use the Ins or Del keys. However, you can change the name of the device driver by writing over the existing name or by first moving to the end of the field with the End key, next erasing the name with the Backspace key, and then addine the new name.

You cannot increase the length of a line in your CONFIG.SYS file, nor can you add more commands to CONFIG.CTL's menu. Let's say you normally have FILES set to 8 but want the option to later increase it to 20. You can reserve a 2-byte field simply by prefacing the 8 with a zero (as you see in Figure 3). Similarly, if you want the ability to add a device driver later, just save a long line enough, with a command similar to

DEVICE-THIS IS A PLACE SAVER.

When you boot up with this nonexistent device command in CONFIG.SYS, DOS will tell you that "this is either a bad or missing device," but now you've reserved a dummy line you can edit to something more useful with the help of CONFIG.CTL. (Note that DOS gets confused if you use a DEVICE= statement without

any argument, so avoid this.)

Another way to add an optionally loadable device driver with minimal boot-time effort is to add the command to the CONFIG.SYS file with everything correct except one letter. Take the example of the periodically needed ANSI.SYS driver. Assuming you keep your root directory uncluttered by storing ANSI.SYS in your DOS directory, you add the command

DEVICE=BOS\ANSI.SYS

to the CONFIG.SYS file. ANSI.SYS won't load it regularly because the path is phony. But when you want ANSI.SYS loaded, just highlight the command from CONFIG.CTL, change the B to a D, press F2, and voilà!

HOW CONFIGCTL WORKS Being a

device driver, there are very few DOS-related things that CONFIG.CTL can do. System calls are limited to keyboard and screen I/O functions 01h through 0Ch and function 30h (Get DOS Version). Thus, CONFIG.CTL can't open the CONFIG.SYS file and read it, much less modify it. Actually modifying CONFIG.SYS

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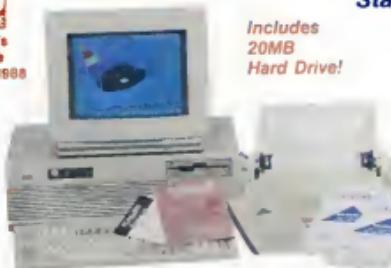
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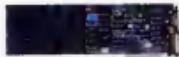
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wouldn't do much good in any case, because by the time CONFIG.CTL gets control, DOS has already read, parsed, and buffered the CONFIG.SYS file.

A .COM file and its command line arguments are placed at 80h of the PSP (program segment prefix), and a device driver is similarly given a pointer to its arguments. The pointer is to a buffer that contains a string that includes the device name as it appears after DEVICE=. This string lets you pass arguments to the driver, just as you do with command line arguments for .COM and .EXE files. The string is terminated either by a carriage return or by a line-feed. It took just a little snooping to confirm my hunch that the buffer also contained all the rest of the CONFIG.SYS strings following CONFIG.CTL's string. As you've probably guessed by now, this buffer is CONFIG.CTL's key to modifying your system's configuration.

The DOS Technical Reference manual states that the buffer string "information is read-only." Such warnings haven't stopped hackers before, of course, so I simply interpreted this to mean "proceed with caution" and "don't be surprised if

your tinkering doesn't work." There may be a system or version of DOS that CONFIG.CTL doesn't work on, though I've had no problems and done rather extensive testing. With that warning, let me proceed by explaining the format of CONFIG.SYS's buffered command strings and how CONFIG.CTL modifies them.

ASCIIZ The DOS *Technical Reference* manual says the device driver's string is terminated with either a carriage return or line-feed. Actually, the line-feed is always there. In most cases, however, the carriage return is replaced with a zero, creating the ASCIIZ string format that DOS uses as a filename terminator. Every command in the string, including things such as the BUFFERS command, has the telltale de-limiting zero and line-feed.

Those who have processed environment strings know that they are similarly zero-terminated and that the entire set of strings is ended by an extra 0 byte. Unfortunately, this double-null-byte terminator convention is not used with the DOS CONFIG.SYS buffer. Apparently, DOS keeps a count of the number of commands

in the buffer instead. (I did not go so far as to unassemble and trace through IBM-DOS.COM, the hidden file responsible for configuring your system. My deductions are based on close observations during sessions of debugging CONFIG.CTL.)

Because CONFIG.CTL doesn't have access to the command count, either through DOS or through CONFIG.SYS, I had to add the terminating dummy-device-command, CONFIG.END, requirement. CONFIG.CTL looks for this in the string of commands as its ending signature. To ensure that DOS won't go bonkers when we go behind its back and modify its CONFIG.SYS buffer, CONFIG.CTL makes sure a zero and line-feed accompany every command and the commands remain the same length. For any commands that are made shorter, the field is padded with trailing spaces. And the buffer has been capitalized so that any modifications are capitalized before they are placed in CONFIG.SYS.

SECRET CODES There's more to the story about the DOS CONFIG.SYS buffer. DOS parses, moves, and compresses

(CONTINUE AS NEEDED)

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what appears to the left of the equals signs into single-byte-codes. For example, if the string

DEVICE=ANSI.SYS<CR><LF>

is in the CONFIG.SYS file, it becomes
DANSI-SYS<@>LF>SI-SYS

This may look rather confusing. What has happened is that DEVICE= has been abbreviated to a 1-byte code, D. Then the driver's name ANS1.SYS—plus the carriage return and line-feed—has been copied so it is snuggled up to the D. In the process, the carriage return has been replaced with a binary zero so as to make an ASCII string. The trailing SI.SYS has no meaning; it just happens to be the remnant left in the buffer after the copying and compression.

This coding method piqued my curiosity. I knew there would be a conflict between the CONFIG.SYS commands BUFFERS and BREAK if only the first

letter of each command were used as a code. So I filled the CONFIG.SYS file with every possible command and then peeked at the DOS CONFIG.SYS buffer at boot time. I discovered a code scheme (shown in Figure 4) with no obvious rhyme or reason. B stands for BUFFERS, as you might expect, but C stands for BREAK. Code Z is used for any command that DOS does not understand. When CONFIG.CTL does its processing of the buffer, it replaces the D code found in front of the dummy CONFIG.END with Z. This results in a milder "Unrecognized command" message when DOS encounters the code, rather than a "A bad or missing config.end" message if DOS tried to load the nonexistent device. The same Z code substitution is used with any user inactivation request.

code can be expanded to a full-fledged functioning driver, however, because all the skeleton structure is present. What CONFIG.CTL does is take advantage of the fact that a device driver is given initialization control as soon as it is loaded, and before any other commands in the CON-

```
BREAK      = C
BUFFERS    = B
COUNTRY    = Q
DEVICE     = D
FCBS       = X
FILES      = F
SHELL      = S
STACKS     = K
LASTDRIVE = L
unrecognized command = ?
```

Figure 4: The 1-byte DOS-buffered CONFIG.SYS command codes, used for the commands found to the left of the equals sign, have curious nonmnemonic abbreviations. The Z is used for any unrecognized command.

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CONFIG.CTL is not a device driver per se; it doesn't drive anything. The assembly

CONFIG.BAS: This BASIC listing, when you run it once, will also create CONFIG.CTL.

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CONFIG.CTL Device Driver

Michael J. Mefford

1988 No. 20 (Utilities)

Purpose: A device driver that lets you modify your CONFIG.SYS file while the system is booting up.

Format:

```
DEVICE=[path]CONFIG.CTL m
[Configuration
  entries to be
  controlled]
DEVICE=CONFIG.END
```

Remarks:

CONFIG.SYS command lines to be edited or bypassed must be placed between the two DEVICE= lines shown above. The *m* parameter sets the number of seconds CONFIG.CTL pauses before continuing with an unmodified normal boot-up sequence. Pressing any key (except Esc) during this pause brings up a point-and-shoot menu of the editable CONFIG.SYS commands.

The Up and Down Arrow keys move the menu highlight bar among the various editable command lines; PgUp and PgDn move the bar to the first and last lines, respectively. Pressing F1 deactivates (or reactivates) the highlighted command. F2 accepts all changes and boots up. Pressing Esc bypasses all CONFIG.CTL actions.

The highlighted line can also be edited, subject to two limitations. First, no completely new line may be added; and second, the number of characters in an existing line may not be increased (it may be shortened). For editing, the Left and Right Arrow keys and the Backspace key are supported; Home and End move to the ends of the highlighted line. The editor operates in overstrike mode. Examples:

```
BUFFERS=803
DEVICE=THIS IS A PLACE SAVER
DEVICE=ANSI.SYT
```

The above BUFFERS line will permit a subsequent increase to 999. The two DEVICE= lines will give harmless error messages normally, but they permit substituting a new device driver and loading ANSISYS by changing a single letter.

Changes made using CONFIG.CTL affect only the current session; they do not permanently modify CONFIG.SYS. If not set, the *m* parameter defaults to 0 (no pause), bypassing the prompt. The CONFIG.CTL program can still be activated in this situation, however, by pressing any key (except Esc) immediately following the boot-up beep.

CONFIG.CTL is already compiled and ready to use. If you prefer, CONFIG.BAS will create CONFIG.CTL when run once in BASIC. The .ASM source code listings are also downloadable, but require you to use a macro assembler (IBM or Microsoft Version 2 or later).

■ UTILITIES

FIG.SYS are implemented.

There isn't room here to go into all the details of how to write a device driver. (You can find that in the DOS *Technical Reference* manual if you like.) But I do want to briefly summarize how a device driver—and particularly CONFIG.CTL—is constructed. A device driver has a .COM file format, with the small difference that no PSP is constructed when you load the file. Thus, the file must be compiled with an offset of 0 instead of the 100h used with .COM files. This is accomplished either by omitting the ORG statement at the beginning of the assembly, or by using an ORG 0 statement.

Instead of starting with executable code, the beginning of the file is a header containing information DOS requires for proper handling of the device. The first double word is a pointer to the next device header, if the two are chained together. Normally, device drivers are installed sim-

gly (for greater flexibility), and the pointer is set to -1, which indicates to DOS that it is the last device driver. The next word of the header contains the attribute of the device type and what services it will support.

- There are two main types of device drivers: character devices (such as ANSI.SYS) and block devices (disk drives).

There are two main types: character devices (such as ANSI.SYS), which handle keyboard and screen I/O; and block devices (such as disk drives), which handle

blocks of data. The next two words of the device header are offsets to the strategy and interrupt procedures of the device.

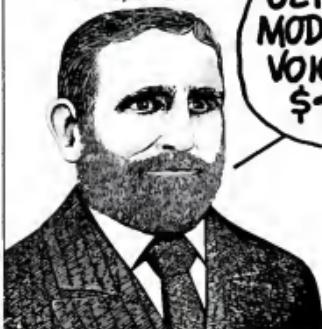
For simplicity's sake, CONFIG.CTL pretends to be a character device that supports no DOS device functions. The strategy entry point of the driver is called only once, immediately after the driver is loaded into memory. Its only task is to save an address passed in ES:BX that points to a common communication buffer (known as a request header) for DOS and the driver. The interrupt entry point is called on all subsequent calls by DOS to the driver, with a command code specifying what DOS wants the driver to do. The command code is in the third byte of the request header. The interrupt procedure is called immediately after the strategy procedure, with command code 0, which is the value for the INIT (initialization) function. It is at this initialization time that CONFIG.CTL does its business of modifying the CON-

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■ UTILITIES

FIG.SYS buffer. A normal device driver would, at this point, do things like chain interrupt vectors or initialize variables.

When the driver exits back to DOS from INIT, a word field in the request header located right after the command code is filled with the status of the call. The eighth bit of this word is set to 1 when the call is done. The 15th bit is set to 1 if there was some kind of error, and the first seven bits are used for the error code. CONFIG.CTL should not be called after the initialization, since all the attribute bits for DOS support are set to zero; but just in case I missed something, any other DOS calls with a command request other than INIT are returned with an "Unknown command" error code.

Part of the INIT function's responsibility is to return the ending address of the resident portion of the driver. Memorywise, a device driver is the same as a TSR and is allotted its protected memory

space. Similar to a TSR's, initialization is done only once and is not needed once the driver is loaded; therefore, it is put behind the resident portion and returned to the system memory pool.

■ Part of the INIT function's responsibility is to return the ending address of the resident portion of the driver.

The DOS 3.x Technical Reference manual suggested a clever stunt. During initialization, a device driver can set the ending address offset to 0 and the segment

to the code segment (CS) if the driver wishes to abort without using any memory. Since CONFIG.CTL has no other business after INIT, this scenario fits CONFIG.CTL perfectly. Unfortunately, however, while the original version CONFIG.CTL did just that and worked fine with DOS 3.3, it hung with all other DOS versions. (The aborting scheme wasn't mentioned in previous versions of the manual, though they didn't say it couldn't be used, either.) The solution was to install CONFIG.CTL with just enough code (about 100 bytes) to return any possible subsequent calls with the unknown command-status return.

In any event, even if you don't get into the programming techniques that make it work, CONFIG.CTL will make it a lot easier for you to do your work!

Michael J. Mefford is a contributing editor of PC Magazine.

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■ ENVIRONMENTS ■ CHARLES PETZOLD

GETTING STARTED IN PRESENTATION MANAGER GRAPHICS

Here's a set of programs that illustrate the various ways you can use the OS/2 Presentation Manager's graphics capabilities to draw and fill areas of different sizes and colors.

The OS/2 Presentation Manager programs I wrote for the last issue simply displayed the text "Hello, world" in a window. These programs showed how the overhead of a Presentation Manager program compares with the overhead of other environments, such as a teletype environment or a full-screen character-mode environment.

With a graphical environment like the Presentation Manager, the "Hello, world" program is a little tame. A program that does something more graphic—like bouncing a ball or displaying a series of random rectangles—would be more fun.

A PM bouncing-ball program is certainly possible, but since it involves animation, it's probably a little too complex for programmers new to the PM. Instead, let's try a program that continuously displays a series of random rectangles in its window. The rectangles will be sized and colored based on random numbers returned from the C rand function.

CONTINUOUS PROCESSING NEEDS
Such a program may at first seem rather easy. Apparently, all we need to do is to find the Presentation Manager function that draws a filled rectangle and set up a simple while loop:

```
while (1)
{
    {draw one random rectangle}
}
```

Simple, right?

Well, no, you don't do it quite this way. The architecture of the Presentation Manager requires a different approach.

Programs for the OS/2 Presentation Manager are message-driven. After a program creates its windows in the main function, it enters a little block of code called the message loop:

```
while (WinGetMsg (hab, &msg, NULL, 0, 0))
    WinDispatchMsg (hab, &msg);
```

This code retrieves a message from the program's message queue by calling WinGetMsg, then dispatches it to the appropriate window procedure by calling WinDispatchMsg. Most of these messages are the result of user input through the keyboard or mouse. Other messages are sent directly to the window procedure, bypassing the message queue. When the window procedure receives a message (this is equivalent to the Presentation Manager calling the window procedure), it processes the message and then returns control to the PM.

The window procedure should process each message as quickly as possible. The

■ Programs that do something more graphic than "Hello, world," such as displaying random rectangles, are a lot more fun to try.

recommended time is a maximum of 1/10 second to process any message. Execution slows when it takes a long time to process a message because the program cannot receive any keyboard or mouse messages until it gets back to the message loop and retrieves them from the queue.

Moreover, if there are keyboard or mouse messages waiting in the program's queue, then no other Presentation Manager program can receive any keyboard or mouse messages. For somewhat complex reasons, the Presentation Manager serializes all keyboard and mouse input. No keyboard or mouse message can be processed until all previous keyboard and mouse messages have been processed.

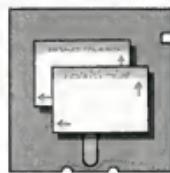
Thus a PM program can't simply sit in a while loop drawing random rectangles. If it did, the program would prevent itself (and all other Presentation Manager programs) from receiving and processing keyboard and mouse messages. Every program in the Presentation Manager session would seemingly ignore all user input! This is clearly not desirable.

THE PM TIMER One solution—but by no means the only solution—is to take advantage of the Presentation Manager timer. This allows a window procedure to receive recurrent messages.

A program starts a timer by calling WinSetTimer with the parameters

```
WinStartTimer (hab, hnd, idtimer, Msec);
```

The idTimer parameter is simply an ID number that the program uses to identify the timer. Msec specifies a time interval,



■ ENVIRONMENTS

in milliseconds, ranging from 0 to 65,535. Every Msec milliseconds, the Presentation Manager places a WM-TIMER message in the program's message queue. The message is addressed to the window procedure whose handle is hwnd.

When the program wishes to stop the timer, it calls WinStopTimer:

```
WinStopTimer (hab, hwnd, idtimer)
```

The Presentation Manager removes any pending WM_TIMER message from the program's message queue when you make this call.

Although you can specify any 16-bit value for the Msec parameter of WinStart-Timer, the PM will round it to the nearest increment of 31.25 milliseconds. The OS/2 system clock ticks 32 times per sec-

```
-----  
# RENDIRECT make file  
-----  
  
rendirect.sbj : rendirect.c  
    cl -c -O2w -W3 rendirect.c  
  
rendirect.exe : rendirect.obj rendirect.def  
    link rendirect /DEBUG /SUBSYSTEM:CONSOLE /LIBPATH:  
-----
```

Figure 1: The RANDRECT make file automates the creation of RANDRECT.EXE.

```

/*-----*
 * RANDOM.C -- Random Routines for 06/2 Presentation Manager
 * Version 1.000 - 10/20/90 - by Dan
 * PC Magazines • Charles Petzold, July 1990
 *-----*/

#define INCL_WIN
#define INCL_DPI
#include <winbase.h>
#include <windef.h>
#define ID_TIMER 1

MESSAGE EXPENTRY ClientWndProc(HWND, USHORT, WPARAM, LPARAM) {
    NMABH bmb;
    int nmb;

    static CLASSINFO esclientClass = { "RandSheet" };
    MSG msg;
    NMHDR nmhdr;
    WNDPROC wndProc;
    GETMESSAGE gm;
    LRESULT lResult = PFC_STANDARD & PFC_MENU;

    bmb.nItem = MinIntializeS (8);
    bmb.hInst = WinCreateSetupGroup (bmb.sClass, 8, 8);
    WinRegisterClass (bmb, esclientClass, ClientWndProc, 0L, 0);

    wndFrame = WinCreateStdWindow (WMNDEF_DESKTOP, 0L, WINVISIBLE,
        SWP_NOCOPYBITS | SWP_NOMOVE | SWP_NOSIZE | SWP_NOACTIVATE |
        SWP_NOOWNERZORDER | SWP_NOZORDER | SWP_DRAWFRAME);
    if (wndFrame == NULL)
    {
        While (WinGetError (bmb, 4096, NULL, 0, 0));
        WinEndBatching (bmb);
        WinCloseWindow (bmb);
    }
    WinCreateSetupGroup (bmb);
    WinRegisterName (bmb);
    return bmb;
}

VOID DrawIt (HPS hps, SHORT esclient, SHORT esclient);
POINT pt1;

OpStartRetteve (hps, 15 + rand () % 16); // Patterns
OpStartColor (hps, (LONG) rand () % 16); // Color
OpStartBackground (hps, (LONG) rand () % 16); // Background

```

ond, or 31.25 ms. per tick. (This is somewhat faster than the DOS system clock, which ticks 18.2 times per second, or has 55 ms. between ticks.) When you specify a value of 0 for Msec, the window procedure gets a WM_TIMER message at the maximum rate of once every 31.25 ms.

THE RANDRECT PROGRAM The three files that constitute the RANDRECT program are shown in Figures 1, 2, and 3. These are the RANDRECT make file, the RANDRECT.C source code file, and the RANDRECT.DEF module definition file. If you have the beta version of the Presen-

tation Manager, you can create the RAN-DIRECT EXE program by running

MAKE RANDRECT

RANDRECT has three functions. *T* of these (main and ClientWndProc) present in almost every Presentation Manager program. The main function is the entry point of the program, and ClientWndProc is the window procedure for program's client window. The DrawRect function is called from ClientWndProc draws a random rectangle.

The main function starts off normally. It first calls WinInitialize to register

```
;-----  
; RANDRECT.DEF module definition file  
;  
  
NAME      RANDRECT  WINDOWAPI  
  
DESCRIPTION  'Random Rectangle (c) 1988, Ziff Communications Co.  
PROTMODE    0  
HEAPSIZE     1824  
STACKSIZE    8192  
EXPORTS      ClientWndProc
```

Figure 3: The *RANDRECT.DEF* module definition file contains information the *LINK* uses in constructing *RANDRECT.EXE*.

```

opnInstaBackground (hpg, _MM_BACKGROUND) ; // Background mix
    ptl_x = rand() % eclient ;
    ptl_y = rand() % ecyclient ;
    opnMove (hpg, sptr) ;

    ptl_x = rand() % eclient ;
    ptl_y = rand() % ecyclient ;
    opnMove (hpg, _MM_FILL, sptr, fl, bl) ; // Opposite corner

    _MM_WAIT (hpg, 1000) ;
}

void EXPTRFC ClientWindowProc (HWND hwind, UWORD msg, WPARAM wpt, LPARAM lpt)
{
    static SHORT esclient, ecyclient ;
    static HBITMAP hpg ;

    switch (msg)
    {
        case WM_CREATE:
            if (!WinStartTimer (hwind, hwind, ID_TIMER, 8))
                KillMessage (hpg, WM_TIMER, hwind,
                            "Cannot run program - Too many clicks or timers",
                            0, 0, 0, NO_INITIALISATION) ;
            return 1 ;
        return 0 ;
    }

    case WM_SIZE:
        esclient = eclient / 100000000 (mp3) ; // Save size of client
        ecyclient = ecyclient / 100000000 (mp3) ;
        return 0 ;

    case WM_TIMER:
        hpg = WindGetBMP (hwind) ;
        DrawRect (hpg, esclient, ecyclient) ;
        WindSetBMP (hpg) ;
        return 0 ;
    }

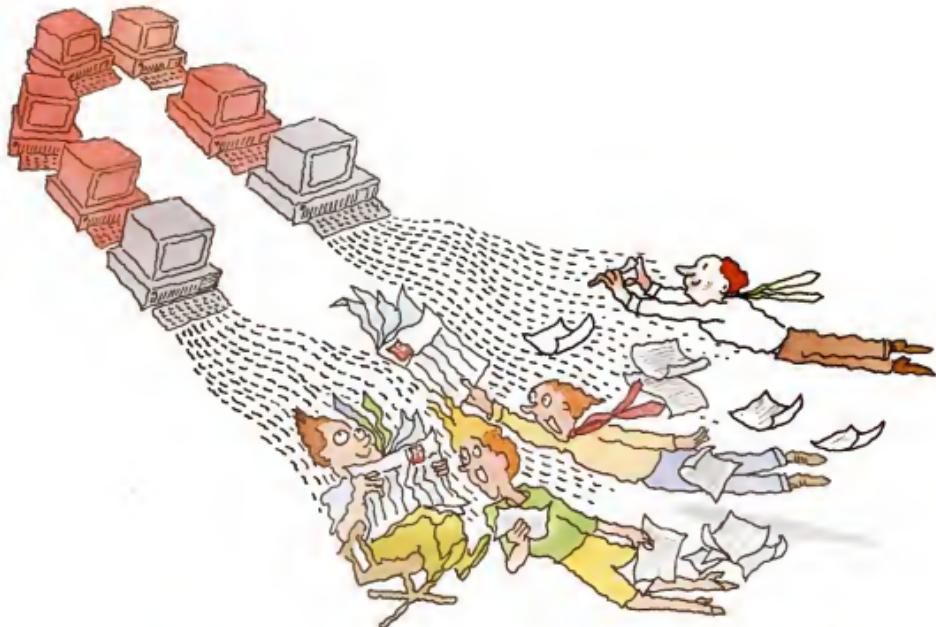
    case WM_EXCHANGEBACKUP: // Erase the background
    return 1 ;

    case WM_DESTROY:
        WinStopTimer (hwind, hwind, ID_TIMER) ;
        return 0 ;
    }

    return MinDefWindowProc (hwind, msg, wpt, lpt) ;
}

```

Figure 2: The RANDRECT.C source code file contains three functions. The main function does initialization; ClientWndProc processes messages to the client window procedure; and DrawIt draws a random rectangle.



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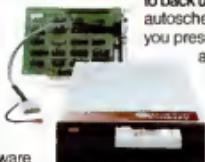


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program with the Presentation Manager. This function returns the anchor block handle that uniquely identifies the process. The anchor block handle is stored in a variable called hab. (This variable is global because it is required in the calls to WinStartTimer and WinStopTimer, which are made from ClientWndProc.)

The main function then goes on to call WinCreateMsgQueue, to create the program's message queue, and WinRegisterClass, which identifies ClientWndProc function as the window procedure for the window class whose name ("RandRect") is stored in the szClientClass variable. This variable is also passed to the WinCreateStdWindow function, which creates the various windows (title bar, system menu, sizing border, client window, and so forth) that make up RANDRECT.

During the WinCreateStdWindow function, ClientWndProc receives its first message, which is the WM_CREATE message. ClientWndProc takes this opportunity to call WinStartTimer to start the timer.

The beta version of the OS/2 Presentation Manager supports only 16 timers system wide. If there are no more available timers when a program calls WinStartTimer, the function returns a 0. If this happens, RANDRECT displays a message box, which is simply a small window with a message ("Cannot run program—too many clocks or timers") and a button labeled "OK." When the user presses that button with the keyboard or mouse, ClientWndProc returns a 1 from the WM_CREATE message.

When a window procedure returns 1 from the WM_CREATE message, the Presentation Manager takes this as an indication that the window initialization was not successful. The Presentation Manager responds to this by aborting the WinCreateStdWindow function and destroying all the windows created so far during the call. The message loop and the WinDestroyWindow call are executed in main only if WinCreateStdWindow returns a valid handle to the frame window.

If ClientWndProc is successful in starting the timer, it returns 0 from the WM_CREATE message and proceeds normally. During WM_DESTROY—the last message that the window procedure re-

ceives before being destroyed—the timer is stopped by a call to WinStopTimer.

ClientWndProc also receives a WM_SIZE message during the WM_CREATE message and whenever

the size of the client window changes. The current dimensions of the window are stored in the static variables cxClient and cyClient for later use in drawing the rectangles.



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DRAWING THE RECTANGLES Earlier PM programs presented in this column have drawn in their windows during the WM_PAINT message. A window procedure receives a WM_PAINT message whenever part of its window is invalid. The window procedure takes this opportunity to update the window.

RANDRECT operates a little differently. It does not process WM_PAINT at all; instead, it draws in the window during WM_TIMER. For each WM_TIMER it receives, ClientWndProc draws one rectangle.

A Presentation Manager program can draw within its window during a message other than WM_PAINT by obtaining a handle to a presentation space through the WinGetPS function. This handle is then used as the first parameter to the graphics output functions. After drawing, the presentation space is released by calling WinReleasePS.

The DrawIt function draws a rectangle using the GpiBox function. The position and dimension of the rectangle are specified with the coordinates of two opposite corners; the sides of the rectangle are always parallel to the x and y axes.

One corner of the rectangle is the current position, which is set by a call to GpiMove. This is set to a random point somewhere within the client window thus:

```
pt1.x = rand() % cxClient ;  
pt1.y = rand() % cyClient ;  
GpiMove (hps, &pt1, );
```

The x coordinate ranges from 0 to (cxClient - 1) and the y coordinate ranges from 0 to (cyClient - 1).

The second point (which denotes the opposite corner of the rectangle) is a parameter to GpiBox:

```
pt1.x = rand() % cxClient ;  
pt1.y = rand() % cyClient ;  
GpiBox (hps, DRO_FILL, apt1, xl, yl) ;
```

The second GpiBox parameter can be set to DRO_OUTLINE (to draw just the outline of the rectangle), DRO_FILL (to draw the interior), or DRO_OUTLINEFILL (to draw the outline and the interior).

Before calling GpiMove and GpiBox, RANDRECT calls four functions to define the appearance of the rectangle's interior. By default, the interior of the rectangle is drawn with a solid pattern. But the solid

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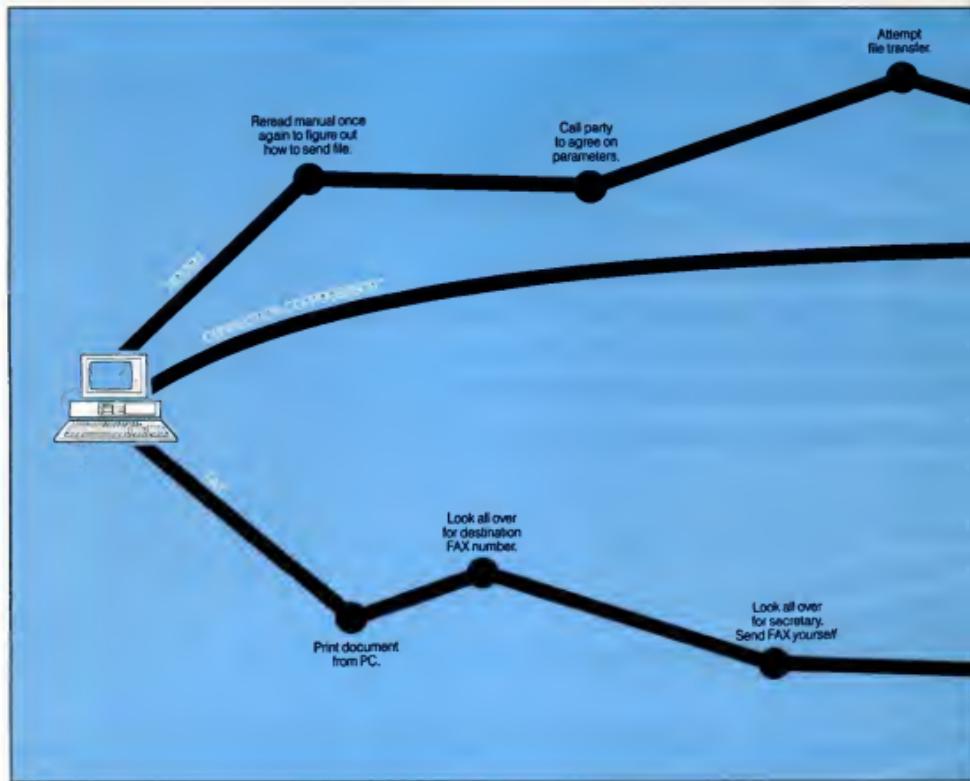
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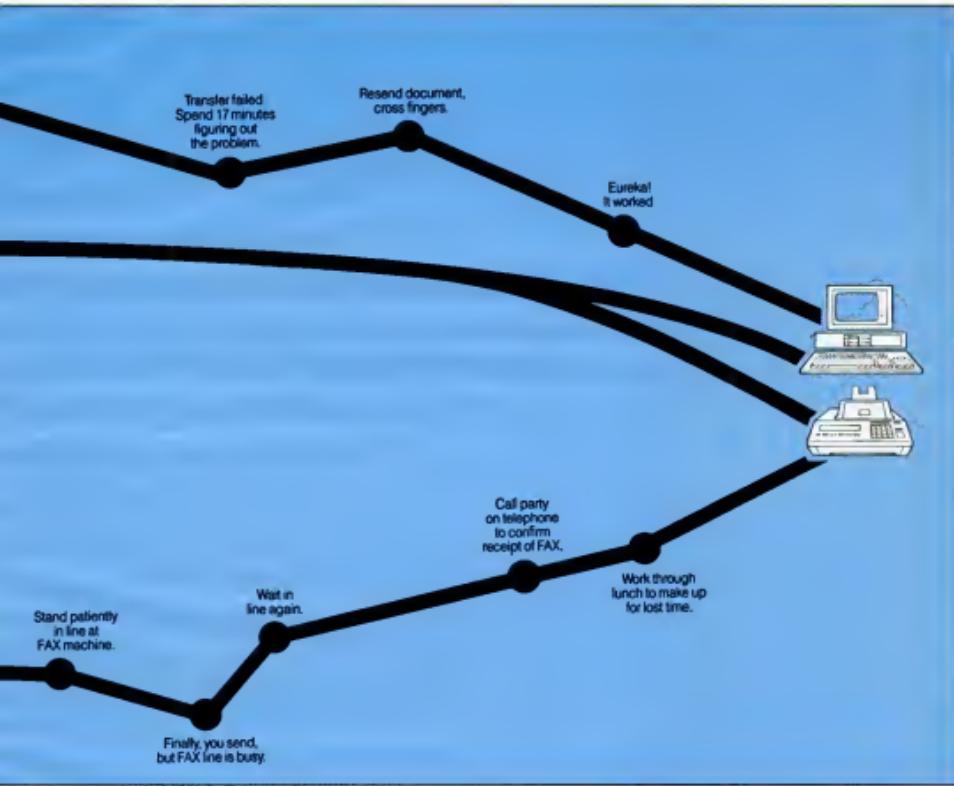
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pattern is only one of 16 patterns (using various diagonal, horizontal, or vertical lines, or dot densities) supported by the Presentation Manager. You set a different pattern by calling GpiSetPattern. Normally, you use an identifier defined in the Presentation Manager header files as a parameter to this function. These identifiers have values ranging from 1 to 16, so RANDRECT selects a random pattern:

```
gpiSetPattern (hps, 1L + rand() % 16);
```

The color of the pattern will normally be the foreground color that you've selected in the Presentation Manager Control Program. By default, this is black. RANDRECT selects a random color by calling GpiSetColor:

```
gpiSetColor (hps, (LONG) (rand() % 16));
```

This is the color of the lines or dots in the pattern. The area between these lines or dots is colored with the current background color; white is the default. RANDRECT again randomly sets this color:

```
gpiSetBackColor (hps, (LONG) (rand() % 16));
```

However, the Presentation Manager default does not use the background color; it simply leaves the background area untouched. You change that default operation by calling GpiSetBackMix:

```
gpiSetBackMix (hps, BM_OVERPAINT);
```

RANDRECT does not keep track of what rectangles it has drawn, so it really can't properly process the WM_PAINT message to update an area of the window that needs repair (as, for example, when another program has obscured part of the client window and is then removed). When part of the client window becomes invalid, ClientWndProc first receives a WM_ERASEBACKGROUND message from the frame window, which is the part of the standard window that lies underneath all the other windows and holds them together. ClientWndProc simply returns 1 from this message to indicate to the frame window to erase the invalid area. Figure 4 shows RANDRECT running under the Presentation Manager.

DRAWING RANDOM ELLIPSES In the DrawIt function of RANDRECT, the last two parameters to GpiBox are set to 0.

You can also set them to positive nonzero values to draw rectangles with rounded corners.

The Presentation Manager uses an ellipse to draw the rounded corners. You specify the width and height of this ellipse with the last two GpiBox parameters. Essentially, the ellipse is cut into four quadrants, and these four quadrants replace the normal corners of the box. If the last two parameters of GpiBox are set to the width and height of the rectangle, then GpiBox doesn't draw a rectangle at all, but instead draws an ellipse.

Figure 5 shows an alternative DrawIt routine that draws random ellipses rather than rectangles. This version uses an array of two POINTL structures to store the two corner points. During the call to GpiBox, the last two parameters are set to the absolute values of the differences of the x and y dimensions. Figure 6 shows a version of RANDRECT using this routine running under the Presentation Manager.

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The GpiBox function is a special case of a generalized area-filling facility in the Pre-

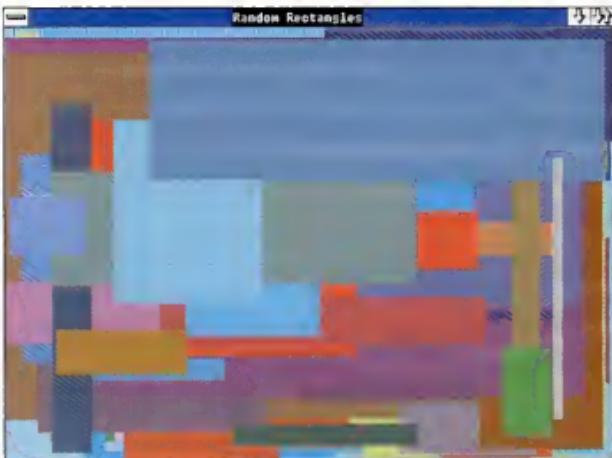


Figure 4: RANDRECT running under the Presentation Manager.

```
VOID DrawIt (NPS hps, SHORT cxClient, SHORT cyClient)
{
    POINTL aptl[2];

    gpiSetPattern (hps, 1L + rand() % 16);           // Pattern = 1 to 16
    gpiSetColor (hps, (LONG) (rand() % 16));         // Color = # to 15
    gpiSetBackColor (hps, (LONG) (rand() % 16));     // Background color
    gpiSetBackMix (hps, BM_OVERPAINT);                // Background mix

    aptl[0].x = rand() % cxClient;                   // First corner
    aptl[0].y = rand() % cyClient;
    gpiMove (hps, aptl);

    aptl[1].x = rand() % cxClient;                   // opposite corner
    aptl[1].y = rand() % cyClient;
    gpiBox (hps, DRC_FILL, aptl + 1, lab (aptl[1].x - aptl[0].x),
            lab (aptl[1].y - aptl[0].y));
}
```

Figure 5: RANDRECT's DrawIt function lets you draw random ellipses rather than rectangles.

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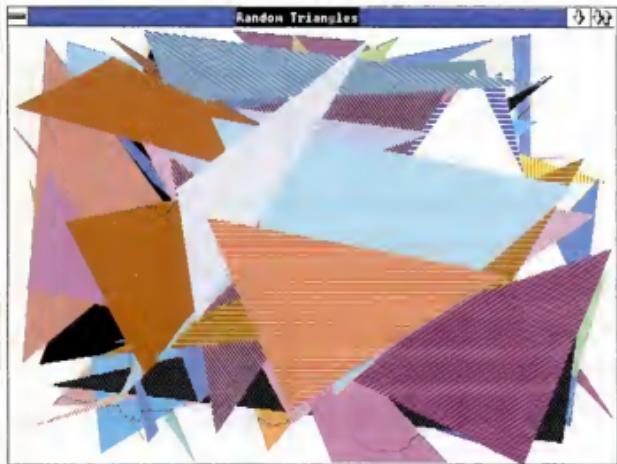


Figure 8: The version of DrawIt shown in Figure 7 draws random triangles.

```
VOID DrawIt (HPS hps, SHORT cxclient, SHORT cyclient)
{
    RECTL rcl;
    SHORT x1, x2, y1, y2;

    x1 = rand() % cxclient;
    x2 = rand() % cxclient;
    y1 = rand() % cyclient;
    y2 = rand() % cyclient;

    rcl.xleft = min (x1, x2); // Lower left corner
    rcl.ybottom = min (y1, y2);
    rcl.xright = max (x1, x2); // upper right corner
    rcl.ytop = max (y1, y2);

    WinFillRect (hps, &rcl, (LONG) (rand() * 16));
}
```

Figure 9: This DrawIt function uses WinFillRect to draw rectangles of random colors.

```
VOID DrawIt (HPS hps, SHORT cxclient, SHORT cyclient)
{
    POINTL aptl[2];
    SHORT x1, x2, y1, y2;

    GpiSetPattern (hps, 1L + rand() * 16); // Pattern = 1 to 16
    GpiSetColor (hps, (LONG) (rand() * 16)); // Color = 6 to 15
    GpiSetBkColor (hps, (LONG) (rand () * 16)); // Background color

    x1 = rand() % cxclient;
    x2 = rand() % cxclient;
    y1 = rand() % cyclient;
    y2 = rand() % cyclient;

    aptl[0].x = min (x1, x2); // Lower left corner
    aptl[0].y = min (y1, y2);
    aptl[1].x = max (x1, x2); // Upper right corner
    aptl[1].y = max (y1, y2);

    GpiBitBlt (hps, NULL, 2L, aptl, ROP_PATCOPY, 0L);
}
```

Figure 10: This DrawIt routine uses GpiBitBlt to copy a pattern to a destination rectangle.

appointing. The Presentation Manager apparently implements GpiBox using the generalized area-filling algorithms, which results in slower rectangle-filling than would be otherwise available. Fortunately, however, the Presentation Manager has two additional functions that can draw filled rectangles much faster than GpiBox.

The simpler of these two functions is the WinFillRect function, which has the following syntax:

```
WinFillRect (hps, &rcl, color);
```

The second parameter is a pointer to a RECTL (rectangle) structure. The last parameter is the color index that you wish to use to color the interior of the rectangle. This overrides the color that you set using the GpiSetColor function. WinFillRect ignores the current pattern when filling the rectangle.

A DrawIt function using WinFillRect is shown in Figure 9. When calling WinFillRect, the xLeft field of the RECTL structure must be less than the xRight field, and the yBottom field must be less than yTop. The DrawIt function in Figure 9 uses the C min and max macros to ensure this difference.

And finally we come to the amazing GpiBitBlt function. A *bitblt* (pronounced "bit blit") is a bit block transfer. GpiBitBlt is normally used to transfer a rectangular bitmap from one place to another. However, the word "transfer" does not quite encompass all that the GpiBitBlt function does. It actually performs a bitwise operation between three bitmaps—a source bitmap, a destination rectangle, and the current pattern. The result of this bitwise operation is copied to the destination rectangle.

The DrawIt function shown in Figure 10 uses GpiBitBlt in a very simple way: to copy the pattern to a destination rectangle. The rectangle is specified by an array of two POINTL structures. The first POINTL structure is the coordinate of the lower-left corner of the rectangle, and the second is the coordinate of the upper-right corner. The second-to-last parameter—set to ROP_PATCOPY in this DrawIt function—indicates that we want the pattern copied to the rectangle.

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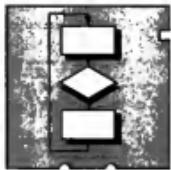
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■ POWER PROGRAMMING ■ RAY DUNCAN

MANIPULATING STRINGS IN MASM



Your Power Programming library expands in this issue to include C-equivalent assembly language routines for string concatenation, extraction, and translation.

The previous Power Programming column presented a package of MASM routines for string comparison, searching, and validation. In this installment, we'll address another category of string operations: concatenation, extraction, and translation. And in the next issue, we'll finish up this series with some case-insensitive string comparison and search routines, as well as a QuickSort routine for string arrays.

MASM STRING PACKAGE #2 The STRINGS2.ASM listing shown in Figure I is the source code for our second package of string routines. It contains six public routines: STRCAT, STRDUP, STRXTR, STRXLT, STRUPR, and STRLWR. All of these procedures accept string pointers and lengths, and they return the address and length of a new string, leaving the original string(s) unchanged. In general, the registers used for parameters and re-

sults are symmetric with the STRINGS1 package presented last time. Further, as with the first string package, the names for some of STRINGS2.ASM routines were picked for symmetry with the C standard runtime library, but you should not assume that the assembler and C routines with the same name do exactly the same thing.

Most of the public routines in STRINGS2.ASM use a building-block routine, STRMEM, which is not public.

```

; STRINGS2.ASM --- NAME string Package #2
; Copyright (c), 1991, BIFF Communications Inc.
; Magazine : Ray Durand - November 29, 1988

;include eqn 1924 ; size of buffer for temporary strings

;_DATA
segment word public 'DATA'
    lctab dw 24 ; 'striw' translation table
    db 'abcdefghijklmopqrstuvwxyz'
    dltab dw 24 ; 'streqp' translation table
    dw 16 ; 'ABCDDEFGHIJKLMNOPQRSTUVWXYZ'

;strbuf db buffers dw(?) ; temporary string buffer
;strptr dw strbuf ; current buffer pointer

;_DATA ends

;_TEXT segment word public 'CODE'
assume cs,_TEXT
;-----+
; STRCAT:           string concatenation routine
;-----+
; Call with:      DD BX = address of string1
;                  DD BX = length of string1
;                  DD BX = address of string2
;                  DD BX = length of string2
;
; Returns:        BX=DX = address of result string
;                  BX = length of result string
;
; Uses:           BX, BX
;-----+
;-----+
;-----+ public _strcat
;-----+
;-----+    public _strcat
;-----+
;-----+    public _near
;-----+
;-----+    push cs          ; save register
;-----+    push bx          ; save string1 address
;-----+    push ds          ; save string2 address
;-----+    mov ax,cs         ; save string1 length
;-----+    add ax,dx         ; BX = result string length
;-----+    call _allocmem   ; get temporary storage for result strin
;-----+    cld              ; copy string1 to result
;-----+    pop bx          ; get string2 address
;-----+
;-----+    pop ds          ; get string2 address

```

```

pop    si
mov    cx,dx
rep    movsb   ; copy string2 to result

push   ss      ; save DS:SI = address of
push   di      ; result string
pop    si
pop    ds
sub    si,bx   ; correct for bytes moved

pop    ss      ; restore register
ret    ; back to caller

```

```

;-----  

; STRDUP: string duplication routine  

; Call with:  DS:SI = address of string  

;             BX = length of string  

; Returns:   DS:SI = address of string copy  

;             CX = temporary storage  

;             BX = length of string copy  

; Items:      nothing
;-----  

public  _strup
strup  proc   near  

        push   cs      ; save registers
        push   ds
        push   si

        cell   althen  ; get temporary storage to hold string copy

        mov    cx,bx   ; make copy of string
        mov    si,cx
        rep    movsb   ; correct for bytes moved

        pop    ss      ; restore registers
        pop    ds
        pop    si
        ret    ; back to caller

```

Figure 1: *STRINGS2.ASM* is the complete source listing for the concatenation, extraction, and translation routines.

(continued)

■ POWER PROGRAMMING

STRMEM uses a very simple ring-buffer strategy to allocate temporary storage for a "result" string. Whenever STRMEM is asked for a certain amount of storage, it returns the current pointer into the ring buffer and then increments the pointer by the specified size, wrapping the pointer when necessary. This means that any storage ad-

dress obtained from STRMEM will eventually be overwritten; its longevity depends on the size of the ring buffer and the size of the strings being placed in it.

The simple allocation strategy used by STRMEM (and thus by all the routines in STRINGS2.ASM) presents no problem in most cases, since the strings are typically

being concatenated, extracted, or translated in order to build other strings—after which they are discarded. However, if you will be performing several other string operations between the time you obtain a result string and the time you use it, you should probably copy it to a local buffer.

STRCAT is a general-purpose string

```

strdup endp
; STRDUPLICATE: string extraction routine
; Cell with: DS:SI = address of string
;             BX = length of string
;             CX = offset of substring
;             DE = length of substring
;
; Returns:  DS:SI = address of substring
;           BX:DX = length of substring
;
;           If BX = 0, then substring offset
;           was invalid and DS:SI is unchanged.
;
; Uses:    nothing
;
; STRDUPLICATE PROC NEAR
;           PUBLIC STRDUPLICATE
;
;           PUSH CS      ; save register
;           ADD SI,BX    ; point to substring
;           SUB BX,DX    ; adjust string length
;           JNS .S1       ; length OK, proceed
;
;           MOV BX,BX    ; bad substring?
;           JMP .S2       ; return length = 0
;
; S1:      CMP BX,DX    ; clamp length?
;           JNS .S3       ; if NO, set substring length
;
; S2:      RET        ; make copy of substring in temporary storage
;
; S3:      POP BX      ; restore register
;           RET        ; back to caller
;
; STRDUPLICATE ENDP
;
; STRTRANSLATE: string translation routine
; Cell with: DS:SI = address of text string
;             BX:DX = length of text string
;             DS:DI = address of translation table
;
;           The translation table has the
;           following format:
;
;           dw number of character codes in table (-1)
;           dw character code of first position (+1)
;           db translation value for character (+1)
;           db translation value for character (+1)
;
;           .
;
;           db translation value for character (+1)
;
;           Any character positions in the table which
;           contain a negative value have no effect
;           in the text string. Entries outside the range
;           defined by the table are unchanged.
;
; Returns:  DS:SI = address of translated string
;           BX:DX = length of translated string
;           DS:DI = translation table address (unchanged)
;
;           PUBLIC STRTRANSLATE
; STRTRANSLATE PROC NEAR
;
;           CALL STRDUPLICATE ; make copy of string to be translated
;           PUSH BX      ; save registers
;           PUSH DS      ; save DS
;           MOV CX,BX    ; use CX for loop count
;           MOV BX,BX    ; save BX for loop length
;
; S1:      MOV BL,[SI]    ; next character
;           MOV BH,BH    ; clear BH
;           ADD BX,[DI+1] ; correct for table base
;           JE .S2        ; jump, outside table
;           CMP BX,[DI]   ; jump, outside table
;           JE .S3        ; jump, outside table
;
;           MOV BX,[BX+DI+1] ; get translation value
;           JE .S4        ; jump, invalid
;           JE .S5        ; jump, ignore it
;           MOV [SI],BL   ; store translation value
;
; S2:      INC SI        ; bump text string pointer
;           LOOP EXITI   ; process next character
;
; S3:      POP SI        ; restore registers
;
;           PUBLIC STRTRANSLATE
; STRTRANSLATE ENDP
;
; STRLWR: convert string to lower case
; Cell with: DS:SI = address of string
;             BX = length of string
;
; Returns:  DS:SI = address of lower-cased string
;           BX:DX = length of lower-cased string
;
; Uses:    nothing
;
; STRLWR PROC NEAR
;           PUBLIC STRLWR
;
;           PUSH DI      ; save registers
;           PUSH BX      ; save BX
;
;           MOV DI,SEG ICHTAB ; DS:DI = address of lower
;           MOV BX,ES:DI    ; case translation table
;           MOV DI,OFFSET ICHTAB
;
;           CALL STRDUPLICATE ; translate the string
;           POP BX      ; restore registers
;           RET        ; back to caller
;
; STRLWR ENDP
;
; STRUPR: convert string to upper case
; Cell with: DS:SI = address of string
;             BX = length of string
;
; Returns:  DS:SI = address of upper-cased string
;           BX:DX = length of upper-cased string
;
; Uses:    nothing
;
; STRUPR PROC NEAR
;           PUBLIC STRUPR
;
;           PUSH DI      ; save registers
;           PUSH BX      ; save BX
;
;           MOV DI,SEG UCHTAB ; DS:DI = address of upper
;           MOV BX,ES:DI    ; case translation table
;           MOV DI,OFFSET UCHTAB
;
;           CALL STRDUPLICATE ; translate the string
;           POP BX      ; restore registers
;           RET        ; back to caller
;
; STRUPR ENDP
;
; STRMALLOC: allocate temporary storage for string
; Cell with: DS:SI = length needed
;
; Returns:  DS:SI = address of temporary storage
;           BX:DX = length (unchanged)
;
; STRMALLOC PROC NEAR
;           PUBLIC STRMALLOC
;
;           MOV DI,SEG STRPTR ; DS:DI = address within
;           MOV BX,BX    ; temporary string buffer
;           ASSUME DS:[BX]
;           MOV DI,STRPTR
;           ADD DI,BX    ; update buffer pointer
;
;           CMP STRPTR,OFFSET [STRBUF+BUFSIZE] ; check for buffer overflow
;           JB .S1        ; jump if no overflow
;
;           MOV BX,DS:[BX] ; temporary string buffer
;           MOV DI,OFFSET STRBUF ; reset buffer pointer
;           MOV STRPTR,DI
;           ADD STRPTR,BX ; update buffer pointer
;           ASSUME DS:[BX]
;
; S1:      RET        ; back to caller
;
; STRMALLOC ENDP
;
; _TINY ends

```

(Figure 1 ends)

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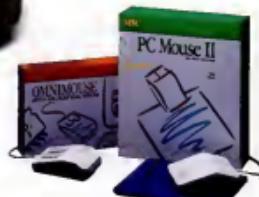
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■ POWER PROGRAMMING

Figure 2: TRYSTR2-ASM provides an interactive demonstration of the STRINGS2 functions.

concatenation routine with the following parameters:

STRDUP duplicates a string. It takes as its arguments

DS:SI = string address
BX = string length

It returns the address of a copy of the original string in registers DS:SI, with all other registers unchanged. STRDUP is used by the other routines in STRINGS2 to copy an argument string before altering it.

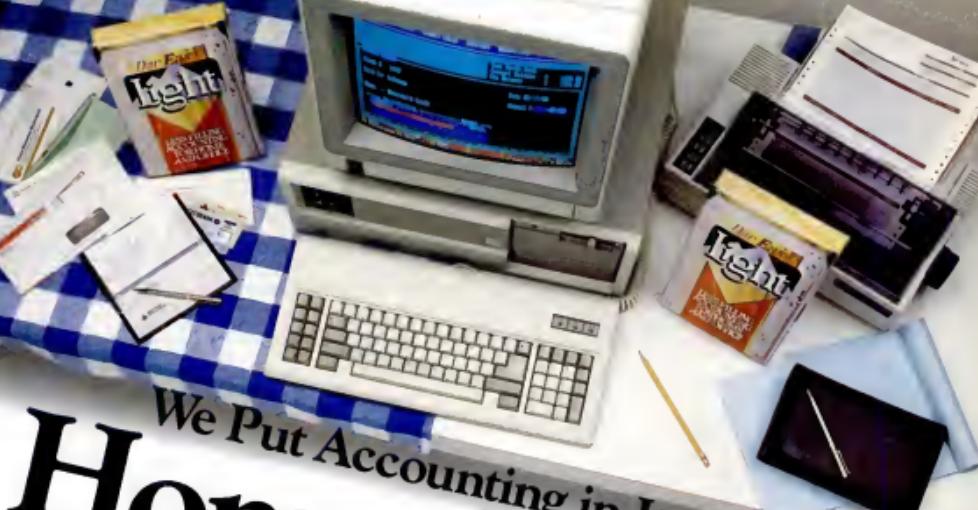
STRXTR extracts a substring. Its parameters are:

DS:SI = string address
BX = string length
CX = offset of substring
DX = length of substring

STRXTR returns the address and length of the substring (which has been copied to temporary storage) in registers DS:SI and BX, with other registers unchanged. If the requested substring overruns the end of the original string, the returned length is reduced so that a true substring is returned. Similarly, if the beginning offset of the requested substring lies outside the original string, a length of zero is returned.

STRXLT translates a string using a supplied character translation table. The **STRXLT** parameters are

DS:SI = address of string to be translated
ES = length of string to be translated
ES:DI = address of translation table



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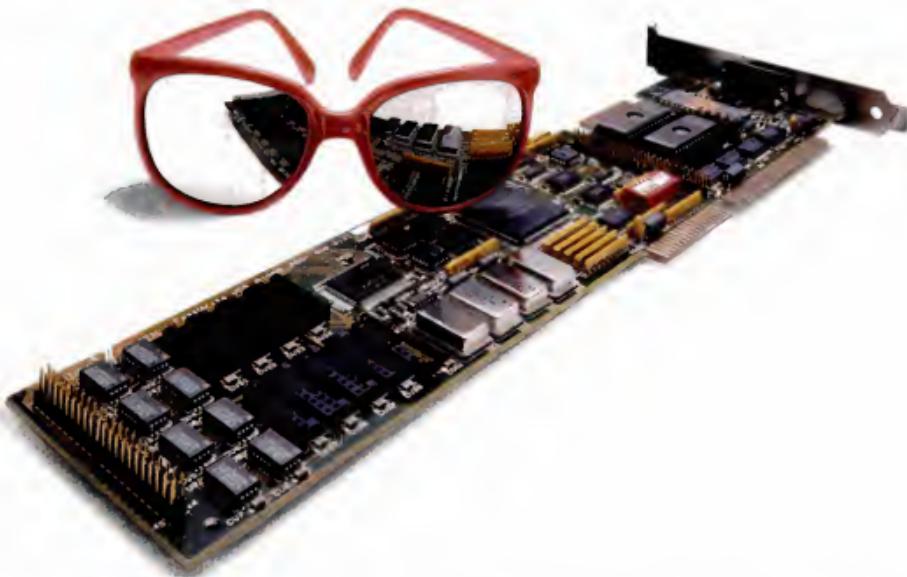
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```
C>trystr2 <Enter>
Enter string 1: THE quick BROWN fox <Enter>
Enter string 2: JUMPED over THE lazy DOG<Enter>
STRCAT: THE quick BROWN fox JUMPED over THE lazy DOG
STRLWR: the quick brown fox jumped over the lazy dog
STRUPR: THE QUICK BROWN FOX JUMPED OVER THE LAZY DOG
Enter string 1: <Enter>
C>
```

Figure 3: A sample session using the TRYSTR2.EXE demonstration program.

The translation table takes the following form:

```
dw    number of translation values in table
db    character code for 1st translation value
db    translation value for 1st character
db    translation value for 2nd character
.
.
```

This format allows you to restrict the table to only those codes you wish to translate. Any zero translation values in the table are ignored by STRXLT. Here is a sample translation table that would change all uppercase vowels to question marks, leaving all uppercase consonants and all lowercase letters, numbers, and oddball characters unchanged:

```
dW    26
dW    'A'
dB    '?BCD?FGH?JKLMN?PQRST?VWXZ?'
```

(Please don't send me any outraged letters arguing that Y isn't really a vowel; this is just an example.) Predictably enough, STRXLT returns the address and length of the translated string in registers DS:SI and BX, leaving the original string and other registers alone.

The STRLWR routine translates a string into lowercase, and the STRUPR routine translates a string into uppercase. Their arguments are

```
DS:SI = address of string
BX    = length of string
```

Both work by calling STRXLT with the address of an appropriate translation table, and both return the address and length of the translated string in registers DS:SI and BX, leaving other registers and the original string unchanged. STRLWR is especially useful when you are making a fully qualified pathname (drive, path, filename, and extension) "pretty" for output.

A DEMONSTRATION PROGRAM

The interactive demonstration program TRYSTR2.ASM (Figure 2) explicitly or implicitly exercises most of the functions in the STRING2.ASM package. It prompts you to enter two strings, concatenates them, and then translates the concatenated string into both upper- and lowercase. To terminate the demonstration program, just press Enter alone in response to the "Enter string 1" prompt, or hit Ctrl-C or Ctrl-Break at any time. A sample session with TRYSTR2 is shown in Figure 3.

To build TRYSTR2.EXE, enter the following commands:

```
MASM /ZI STRING2.S;
MASM /ZI TRYSTR2;
LINK /CO TRYSTR2+STRING2.S;
```

If you don't want to trace through the demonstration program with CodeView, you

```
string2.obj : string2.asm
masm /ZI string2;
trystr2.obj : trystr2.asm
masm /ZI trystr2;
trystr2.exe : trystr2.obj string2.obj
link /CO trystr2+string2;
```

Figure 4: A Make file that will facilitate the creation of the TRYSTR2.EXE demonstration program in Figure 3.

can omit the /ZI and /CO switches. You can use the Make file in Figure 4 to automate the process of creating TRYSTR2.EXE.

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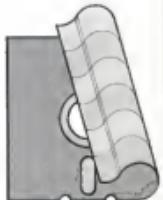
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Converting numeric labels with trailing plus and minus signs into values, plotting more than six data ranges in a single XY graph, and fixing a /Data Query Find bug in Lotus 1-2-3.

How to fix a /Data Query Find bug in Lotus 1-2-3

We've discovered an interesting 1-2-3 bug. We issued the /Data Query Find command, highlighted and then edited a record, and pressed Enter. When we subsequently pressed the Cursor Up and Down keys, 1-2-3 began highlighting an entirely new subset of records.

The worksheet shown in Figure 1 will demonstrate this bug. After setting up this worksheet, we used the /Data Query Input command to define cells A8..C20 as the Input range, and used the /Data Query Criterion command to define cells A5..C6 as the Criterion range. Consequently, when we issued the /Data Query Find command, 1-2-3 highlighted the record in row 12—the first record with the label 'South' in its Division field. When we pressed the Cursor Down key once, 1-2-3 moved the highlight to the record in row 16—the second record with the label 'South' in its Division field; when we pressed Down again, 1-2-3 moved the highlight to the record in row 18—the final record with the label 'South' in its Division field. So far, so good.

However, suppose you edit or replace one of the fields of one of the highlighted records while using the /Data Query Find command. You'd do this either by typing a new entry and then pressing Enter, or by pressing the Edit key, changing the entry, and then pressing Enter.

As you would expect, the record you have edited will remain highlighted after

you edit it. However, if the worksheet was set for Automatic recalculation when you made the change, 1-2-3 no longer will highlight records that have the label 'South' in their Division field when you subsequently press the Up or Down keys. Instead, it highlights records that have the Division entry 'West—the records in rows 10, 13, and 20.

Apparently, if 1-2-3 recalculates a worksheet during a /Data Query Find command (as it will when you edit a record

with the worksheet set for Automatic recalculation) and that worksheet contains one or more @D functions, 1-2-3 will begin using the criterion range specified by the last @D function it calculated as the Criterion range for the /Data Query Find command.

In this case, the function

`@DSUM($A8..$C20,2,D1..D2)`

will be the last one to be recalculated. Since this function specifies cells D1..D2

A	B	C	D
Name	Division	Sales	Division
1 North	South	East	West
2 \$165,000	\$142,000	\$138,000	\$150,000
3			
4			
5			
6 Name	Division	Sales	
7	South		
8 Name	Division	Sales	
9 Smith	East	\$55,000	
10 Jones	West	\$53,000	
11 Williams	North	\$25,000	
12 Johnson	South	\$45,000	
13 Davis	West	\$65,000	
14 Stevens	North	\$35,000	
15 Carter	East	\$34,000	
16 Hunter	South	\$30,000	
17 Richards	North	\$45,000	
18 Walker	South	\$67,000	
19 McCoy	East	\$49,000	
20 Cox	West	\$32,000	

Cells B20..E20 contain the following functions:

```
B20: @DSUM(A8..C20,2,A1..A2)
C20: @DSUM(A8..C20,2,B1..B2)
D20: @DSUM(A8..C20,2,C1..C2)
E20: @DSUM(A8..C20,2,D1..D2)
```

Figure 1: If 1-2-3 is set for Automatic recalculation, odd things happen in this worksheet when you issue the /Data Query Find command, edit a highlighted record, and then press the Cursor Up or Down keys.

■ SPREADSHEET CLINIC

as its criterion range, and since cell D1 contains the field name 'Division' and cell D2 contains the label 'West', 1-2-3 will begin looking for records with 'West' in their Division field after you complete the edit.

Fortunately, there is an easy solution to the problem: simply set your worksheet to Manual recalculation before you issue the /Data Query Find command. That way, 1-2-3 won't recalculate the worksheet as you make changes to criterion-matching records during the execution of a Query Find command. Consequently, none of the @D functions in the worksheet will alter the criterion used by the /Data Query Find command.—*Bill Monaghan and Barbara Rudder; Fairfield, New Jersey*

Fortunately, the circumstances in which you will encounter this bug are rare. The first condition is that the worksheet must contain an @D function that references a criterion range other than the one /Data Query Find is using; second, the worksheet must be set for Automatic recalculation. Nevertheless, we're surprised that Lotus didn't find and correct this clear-cut bug before shipping 1-2-3, Release 2.01.

Productivity Tip

To generate upper-level characters in 1-2-3, you probably use the @CHAR function or the Compose key. However, you can also generate upper-level characters by holding down the Alt key and typing the ASCII number of the character you want to generate on the numeric keypad.

How to plot more than 1-2-3's limit of six data ranges in a single XY graph

In theory, 1-2-3 allows you to have only six Y ranges (A through F) in a single XY graph. In practice, however, there's a way in which you can plot seven—or as many ranges as you want.

To do this, enter or copy the X and Y values into adjacent cells of a single pair of columns, leaving a blank row between the row that contains the last value for one series and the row that contains the first value for the next series. You then specify the

entire column of X values as the X range, and the entire column of Y values as the A range. Since 1-2-3 treats blank cells as breaks in an XY graph, it does not draw a line connecting the end point of one "range" with the starting point of the next

range, so you get a separate line for each series.

Suppose, for example, you want to plot the seven sets of XY pairs in the worksheet shown in Figure 2. To do this, you would copy the X values in cells A2 and A3 into

	A	B	C	D	E	F	G	H
1	X-Range	A-Range	B-Range	C-Range	D-Range	E-Range	F-Range	G-Range
2	1	2	3	4	5	6	7	8
3	2	3	4	5	6	7	8	9
4								

Figure 2: A sample of seven series of XY values to be plotted in a single XY graph.

	A	B	C	D	E	F	G	H
1	X-Range	A-Range	B-Range	C-Range	D-Range	E-Range	F-Range	G-Range
2	1	2	3	4	5	6	7	8
3	2	3	4	5	6	7	8	9
4								
5	1	3						
6	2	4						
7								
8	1	4						
9	2	5						
10								
11	1	5						
12	2	6						
13								
14	1	6						
15	2	7						
16								
17	1	7						
18	2	8						
19								
20	1	8						
21	2	9						
22								

Figure 3: After putting the XY series into a pair of columns, you can plot them in an XY graph.

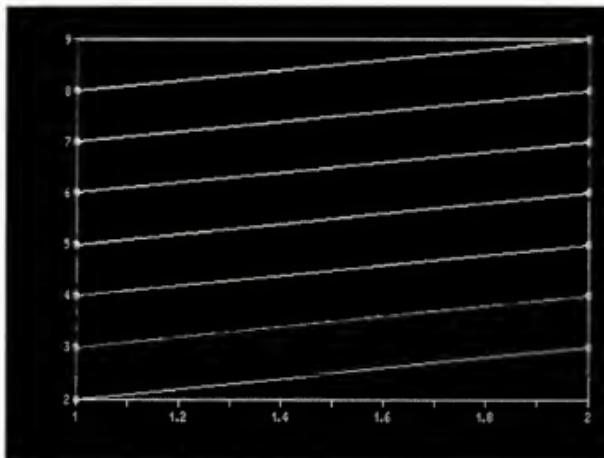


Figure 4: The XY graph plotting the seven series of XY pairs shown in Figure 3.

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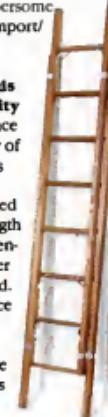
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CIRCLE 173 ON READER SERVICE CARD

■ SPREADSHEET CLINIC

cells A5..A6, A8..A9, A11..A12, A14..A15, A17..A18, and A20..A21. Then, you would copy or move the values in cells C2..C3 into cells B5..B6, those in cells D2..D3 into cells B8..B9, etc., so your worksheet looked like Figure 3.

Having arranged the data in this way, you can plot them in a single XY graph by issuing the /Graph command, choosing Type, and then choosing XY. Next, choose X, highlight cells A2..A21, and press Enter. Then similarly choose Y, highlight cells B2..B21, and press Enter again.

If you choose the View command after completing these steps, 1-2-3 will produce the graph shown in Figure 4. Each series becomes a separate line in the graph.
—Mark Weih; Cambridge Springs, Pennsylvania

You can use this technique to plot as many series of values as you wish in an XY graph. However, since all the X values are part of the same X series and all of the Y values are part of the same Y series, 1-2-3 will use the same pattern, color, and marker for each of the lines in the graph. Fortunately, this is a small price to pay for the ability to graph more than six data series in a single XY graph.

Productivity Tip

If you've ever wished that you could see more of your 1-2-3 or Symphony worksheet at a time, then you should use *SeeMORE*—an add-in application from Personics Corp. Depending on what sort of monitor you have (CGA, EGA, or VGA), *SeeMORE* will allow you to view up to 160 columns and 60 rows of a worksheet at a time. *SeeMORE* for 1-2-3 is \$79.95; *SeeMORE* for Symphony is \$99.95. To order *SeeMORE*, call Personics Corp. at (800) 445-3311.

A quicker way to convert numeric labels with trailing plus and minus signs into values

Mark Schoenfeldt offered a macro solution to the problem of converting numeric labels with trailing + and - signs into val-

ues in the February 29, 1988, Spreadsheet Clinic. Although his macro works well, I prefer an alternative technique. Specifically, I use a single-line formula like

```
=VALUE(@LEFT(cell,@LENGTH(cell)-1))  
+IF(@RIGHT(cell,1)="+",1,-1)
```

where *cell* represents the name or address of the cell that contains the numeric label.

When 1-2-3 evaluates this formula, it starts by calculating the @LEFT function, which extracts all but the final character (either a + sign or a - sign) from the entry in the referenced cell. If the referenced cell contained the label '123.45+', the function would return the string "'123.45'". The program then evaluates the @VALUE function, which converts the extracted characters into a value. In this example, the @VALUE function would return the value 123.45.

The value is then multiplied by the result of the @IF function. If the last character in the referenced cell is a +, this function will return the value 1. Consequently, 1-2-3 will return the unaltered result of the @VALUE function. If the final character is a -, however, 1-2-3 multiplies the result of the @VALUE function by the value -1. Thus, if the referenced cell contained the label '123.45-', 1-2-3 would return the value -123.45.—Mark Thompson; Dallas, Texas

The formula approach is faster than using a macro when you want to convert a large number of labels into values. Simply enter the formula to the right of the topmost cell in the column whose entries you want to convert. Then, use the /Copy command to make a copy of the formula for each of the labels in that column. Finally, use the /Range Values command to replace the formulas with their results.

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CIRCLE 157 ON READER SERVICE CARD

■ NEIL J. RUBENKING

USER-TO-USER

Here's how you can unprotect BASIC files, keep your path statements short, make the date available to all your batch files, and use the prompt to remind you that you're in a DOS shell.



Speed batch file execution with simulated CASE statement

Using ERRORLEVEL for branching is slow if you use a long series of IF statements. My modification in Figure 1 sets an environment variable with the ERRORLEVEL and then uses it as a CASE selector. The program GETKEY.COM is a public domain program that returns the ASCII value of a keystroke in the ERRORLEVEL. Of course, you can use any program that sets the ERRORLEVEL.

The FOR statement compares the ERRORLEVEL with the numbers in the loop, setting the environment variable "opt%" to the ERRORLEVEL. %opt% (the value of "opt") is then appended to the word CASE, forming labels such as CASE1. This causes the GOTO statement to go to the corresponding label.—John L. Center; Pittsburgh, Pennsylvania

```
N GETKEY.COM
RCX
8
A100
MOV AH, 0
INT 16
MOV AH, 4C
INT 21

W
Q
```

Figure 1: GETKEY.SCR produces GETKEY.COM, which returns the ASCII value of a keypress in the ERRORLEVEL.

```
ECHO OFF
CLS
:CASES
ECHO WHAT would you like to do now?
ECHO (S) Run Spreadsheet
ECHO (D) Run Database
ECHO (W) Run Word Processor
ECHO (Q) Quit
GETKEY
SET opt=%
REM 68=0, 81=Q, 83=S, 87=W, 108=d, 113=q, 115=w, 119=w
FOR %%e IN (68 81 83 87 108 113 115 119) DO IF ERRORLEVEL==%%e SET opt=%%%e
GOTO CASE%opt%
:CASE115
:CASE83
ECHO Pretending to run Spreadsheet
PAUSE
GOTO CASES

:CASE68
:CASE108
ECHO Pretending to run Database
PAUSE
GOTO CASES

:CASE119
:CASE87
ECHO Pretending to run Word Processor
PAUSE
GOTO CASES

:CASE113
:CASE81
ECHO ENDING it all
```

Figure 2: The BAT..CASE.BAT file avoids the usual glut of IF ERRORLEVEL statements by creating a simulated CASE statement.

It's easy to forget that you can use the FOR statement for any group of values, not just filenames. Try this at the DOS prompt:

```
FOR %V IN (THIS IS A TEST) DO ECHO %V
```

To use this CASE method for batch files, you'll need to create the program GETKEY.COM. Type in GETKEY.SCR (Figure 1) first, as a flat ASCII file. Be sure to include the blank lines before W

and after Q. Pass this program as input to DEBUG by entering this command:

```
DEBUG < GETKEY.SCR
```

This will produce the program GETKEY.COM.

Now try the batch file BAT..CASE.BAT shown in Figure 2. Of course, you can substitute your own programs for the menu options and use any standard keyboard key for the choices. In the FOR

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statement, put the ASCII key numbers in ascending order. Note the doubled labels for capital and small letters; by placing one immediately after the other, you make them perform the same set of actions. If the user presses a key that's not in the list, the variable "opt" keeps the value 0, so the GOTO statement jumps back to CASE0 and presents the menu again.

Keep path statements short by creating special paths for each application

I like to keep my path as short as possible to minimize directory searches and disk activity. In order to maintain a minimum path, I start programs with batch files that save the current path, change the path to that required by my application, start the application, and then restore the original path. The file SAVEPATH.BAT, shown in Figure 3, is an efficient way to do this. The second line stores the current path in the "oldpath" environment variable. Lines 3 and 4 set up the new path and invoke my application. Lines 5 and 6 restore the original path and remove "oldpath" from the environment.

If you keep the external DOS command programs in C:\DOS and batch files in C:\BAT, the path you set in your AUTOEXEC can be as simple as PATH=C:\DOS;C:\BAT. This can greatly reduce the number of directories and filenames that DOS must search to start an application.

It is a good idea to minimize the use of the APPEND command because of its side effects (see User-to-User, PC Magazine, July 1988). However, a minimum APPEND path can also reduce directory searches and disk activity. In order to accomplish this, I start programs requiring

```
ECHO OFF
SET OLDPATH=%PATH%
PATH C:\MYAPP
MYAPP &1
PATH %OLDPATH%
SET OLDPATH=
```

Figure 3: This batch file sets up an application-specific path, then restores the original path.

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PRODUCTIVITY

■ USER-TO-USER

```
ECHO OFF
APPEND | FIND /V "No Append" > C:\APATH.BAT
APPEND C:\MYAPP\SAVEAPP
C:\UNPAK\APATH
APPEND:
C:\APATH.BAT
```

Figure 4: A batch file that protects you from the side effects of the APPEND command.

an APPEND path with a batch file that saves the old APPEND path, changes it to one appropriate for my application, executes the application, and restores the original APPEND path. The file SAVEAPP.BAT shown in Figure 4 demonstrates how this can be accomplished.

SAVEAPP.BAT works in the following manner. In line 2, APPEND with no arguments echoes the APPEND path. If there is none, it echoes "No Append." FIND /V filters out the "No Append" line, so APATH.BAT contains either an APPEND= command or nothing. Line 3 sets up the appropriate new APPEND path, and line 4 invokes my application. Line 5 clears the APPEND path, and line 6 runs APATH.BAT. If there was a prior APPEND path, the APATH.BAT file restores it; if not, it does nothing.—*Curt Finley, Davis, California*

APPEND is a Band-Aid for programs that don't support subdirectories. When you absolutely must use it, the method described here will protect you from its side effects. Note that lines 2 and 6 in SAVEAPP.BAT save and restore the previous APPEND path. The safest practice is to have no APPEND path except when it's needed—if you do that you can omit these lines.

SAVEPATH.BAT wipes out your existing path and replaces it with one specific to the application. Sometimes you may want to keep the existing path and just add another directory to it temporarily. For example, if your application allows you to shell to DOS, you'll want your DOS programs and batch files to be accessible. In that case, just change the third line of SAVEPATH.BAT to

```
PATH C:\MYAPP;%PATH%
```

As before, the final lines restore the original path and clear the environment variable "oldpath."

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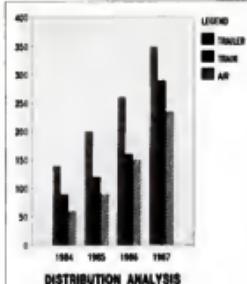


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■ USER-TO-USER

Make today's date available to all your batch files

I added the lines suggested by Mr. Trombetta in the August 1988 issue of *PC Magazine* to my AUTOEXEC.BAT:

```
ECHO | MORE | DATE > READDATE.BAT
READDATE
```

However, I modified CURRENT.BAT to

```
ECHO OFF
SET TODAY=%4
```

Parameter %4 is the date in the line "Current date is Sun 7-17-1988."

This permits me to use the variable %today% in any batch file to input the current date. For example, I often use XCOPY to copy files that were modified during the day from my hard disk at work to a floppy to take home. Now, instead of typing "xcopy c: a: /d:7-17-1988", I can

run a batch file with the line

```
XCOPY C: A: /D:%today%
```

—Allen K. Easley, Topeka, Kansas

You might expect that DOS would supply the current date as a standard environment variable—but you'd be wrong. It's not there unless you put it there. The file READDATE.BAT contains the output of the DATE command, something like

```
ECHO OFF
ECHO | MORE | DATE > READDATE.BAT
READDATE
```

```
ECHO OFF
SET TODAY=%4
DEL READDATE.BAT
```

Figure 5: Use these two batch files, TODAY.BAT and CURRENT.BAT, to get the date into the environment.

"Current date is Sat 8-20-1988." DOS interprets that line as a call to CURRENT.BAT with these four parameters: "date," "is," "Sat," and "8-20-1988."

To try out this method, type in the batch files TODAY.BAT and CURRENT.BAT shown in Figure 5. You'll note that I added a line to CURRENT.BAT that deletes READDATE.BAT—once READDATE has served its purpose, it's of no further use. After you run TODAY.BAT, the environment variable "today" is available to all your other batch files. If you find this helpful, you'll want to include the commands from TODAY.BAT at the end of your AUTOEXEC.

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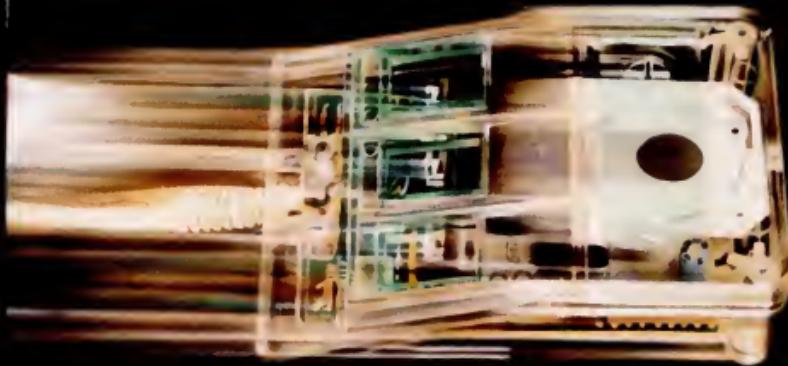
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1/26/88—IBM's OS/2 reviewed; PC Labs tests 20 MHz DESKpros; do-it-yourself 386s; 17 Lotus 1-2-3 add-ins; add-in word processors; database management; and printing; graphics utilities; sharing laser printers; Turbo Pascal 4.0; music programs; 6 new fax boards examined; FREE Paint program; more.



1/12/88—THE BEST OF 1987-88 Annual Best & Worst Editors' Personals & Picks: 1987 Awards for Technical Excellence; Tandy's 1000 Series; remote computing solutions; 4 Fiber-optic LANs; PC Labs tests 5 communications programs; 3 plug-and-play data transfer products; FREE Help utility; more.



12/2/87—Microsoft Excel reviewed; PC Labs tests 9 affordably priced 386-based PCs; 16 EGA Plus cards reviewed; 8 plotters; 6 TSB note-takers; 5 sales lead-trackers; Microsoft Windows; Omni's Quartz; Windows Graph; adding subdirectories and hard disk compatibility to rejuvenate old programs; FREE PRN2FILE.COM program printing utility; more.



12/8/87—15 hard disk storage cards examined; mail-order hard disks; 16 CAD packages priced under \$500; dBASE report writers; one-time PCs; Word 4.0; E-Mail for LANs; the Price Waterhouse Report integrated accounting package; creating and using program libraries; FREE CD copy utility; more.



11/24/87—Apple's Macintosh II system examined; networking IBM and Macintosh; optimizing Turbo Pascal; Power Programming column premieres; 386 operating systems; 5 full-page, black-on-white monitors for desktop publishing; disk caching; FREE Stick cursor stabilizer utility; more.



11/10/87—PC Labs torture tests 106 printers; 36 laser printers; \$1,295-\$18,750, 300-1200 dpi; 65 dot-matrix printers; 5 daisy-wheel printers; soft-font printer; first look at Microsoft Excel; customizing cursors with CTYPE; Compaq Desktop 8520 and portable 386; FREE SAFARI super clipboard utility works with any application; more.



10/27/87—PC Labs tests 10 hot spreadsheets; 3D spreadsheets that provide missing links; new models, new screens for laptops; 6 presentation-size monitors; 386 Turbo boards; the new Multi-Mate test-oriented database software; FREE super clipboard utility works with any application; more.



10/13/87—Desktop publishing on the PC; PC Labs tests GEM Desktop Publisher, The Office Publisher, PageMaker and Ventura Publisher; the best large-screen monitors; laser printers; mice and scanners; 7 highest-speed ATs; 32 breakthrough text and graphics scanners; 31 spelling checkers; 31 address book pop-up; address book and dialer; more.



9/29/87—PC Labs tests 12 hot 386 boxes; 12 keyboard macro programs; 13 full-featured project managers; laptop add-ons; 14 disk diagnostic programs; 9 Norton challengers; 11 AT multifunction boards; 6 database graphic systems; TSR desktop organizers; 13 Sidekick rivals; FREE Directory Magic utility program; more.



8/87—36 high-tech input devices examined including tablets, trackballs, touchscreens, light pens, mice and keyboards; 9 Norton challengers; 11 AT multifunction boards; 6 database graphic systems; TSR desktop organizers; 13 Sidekick rivals; FREE Directory Magic utility program; more.

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■ USER-TO-USER

BASIC. I use it because I like to see their listings to learn new things.

The first step is to type and run this short program:

```
10 DEF SEG
20 BSAVE "UNPROBAS",1124,1
RUN
```

LOAD the program you want to unprotect, and then BLOAD the file UNPROBAS. That unprotects the file. Now LIST the program to see its contents, or SAVE it unprotected.—*Hamad Ali; Muharraq, Bahrain*

Every year or so this tip comes up again; it's a shame they don't just put it in the manual. When you save a BASIC file with the P option, it sets a flag in the program's header that tells BASIC not to LIST or SAVE the program. BLOADING the UNPROBAS file overwrites that flag. Note that once you've created UNPROBAS,

you can just store it with your BASIC files and use it as needed.

Here are the exact instructions to type into the BASIC interpreter if you want to unprotect a file called SECRET.BAS:

```
LOAD "SECRET"
BLOAD "UNPROBAS"
SAVE "SECRET"
```

That does it.

Have your prompt remind you that you're in a DOS shell

Many programs provide the ability to exit temporarily to a secondary copy of COMMAND.COM. Although there is usually an initial indication that you are in a secondary command shell, it quickly scrolls off the screen.

One solution I have found is to invoke such programs with a batch file that in-

cludes the following commands:

```
SET PROM=%PROMPT%
SET PROMP%=[%S%]PROMPT%
(other commands to invoke program)
SET PROMP%=%PROM%
```

The first two SET commands save the current value of the DOS prompt in the environment variable "prom" and prefix the prompt with the name of the batch file. The last SET command restores the prompt to its original setting. Now if I use the DOS shell facility of the program invoked by the batch file, I have a clear indication that this is not the primary copy of COMMAND.COM.

The batch file SETPROMP.BAT shown in Figure 6 demonstrates this technique. This batch file invokes a secondary copy of COMMAND.COM, which will remain the active command processor until it receives an EXIT command. Until the secondary COMMAND.COM exits, the DOS prompt will be prefixed with [SET-

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■ USER-TO-USER

PROMP] (assuming you name the batch file SETPROMP.BAT). When you EXIT the secondary shell, the prompt will return to its normal assignment.—*Marc D. Reibstein; Blackwood, New Jersey*

It's easy to forget that you're running in a shell—it looks just like DOS. Some programs (*WordPerfect*, for example) already provide a reminder, but for those that don't, this is a nice solution. If you prefer, you can include a more explicit message

than the bracketed batch file name. For example, replace the third line of SETPROMP.BAT with

```
SET PROMPT=[EXIT to return]@PROMPT%
```

Try running SETPROMP.BAT several times in a row. Each time you run it you invoke another secondary COMMAND.COM, and each time your prompt grows. To get back to the main command processor, just keep entering EXIT until your prompt returns to normal.

```
ECHO OFF
SET PROMP=%PROMPT%
SET PROMPT=[%0]@PROMPT%
ECHO EXIT to return to the primary COMMAND.COM
COMMAND
SET PROMPT=%PROMPT%
SET PROMP=
```

Figure 6: This batch file demonstrates how the prompt can remind you that you're running in a secondary command processor.

Productivity Tip

Instead of typing *. to mean "all files," use a period. DOS recognizes that the period means the current directory. So,

TOUCH .

has the same effect as

TOUCH *.*

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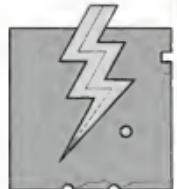
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POWER USER



Preserving blank lines in dBASE labels; executing dBASE commands more quickly by suspending the index; avoiding blank lines when printing form letters in Microsoft Word.

Creating and storing a timekeeping log in WordPerfect

As an attorney in a small law firm, I do much of my own document creation and editing in *WordPerfect*. The two simple macros shown in Figure 1 help me keep track of the time spent on these tasks. The macros allow single-key input for creating and storing a timekeeping log in Doc 2. The log records the starting and ending times of any project, phone call, etc.

Alt-S records the start of the time period, leaves the cursor positioned for the ending entry, and returns immediately to the current document. Alt-E records the ending time, lets the user enter a descriptive

portion of the task, and returns to the current document.—Ken Freudenberg; Durango, Colorado

```
<ctrl-f10>      Begin macro definition
<alt-s>          Press Alt-S
<shift-f3>       Go to Doc 2
<none><home><down>  Go to end of document
<shift-f5>2      Set date format
<tab>#1/1/S<tab>#1<tab>
                (or the date/time format
                string of your choice)
<cr><cr>        End Date/time format
ST              Designate "Start"
<shift-f5>1      Insert date/time
<shift-f5>2      Set Date Format
3<space>1,<space>4  Reset normal date format
<cr>
FT              Exit date function
<cr>
<shift-f3>       Move to new line
<ctrl-f10>       End macro definition
```

Figure 1: Two simple WordPerfect macros that let you keep a time log as Doc 2.

If you need Doc 2 for other purposes, you can use the Append Block feature to capture your time log. Figure 2 shows a version of Alt-S implemented that way.

The corresponding Alt-E macro will be similar.—Neil J. Rubenking

Speeding the execution of dBASE commands by temporarily turning off the index

While indexes are indispensable adjuncts to dBASE databases, you will find that if you close all indexes, commands such as SUM and RECALL will execute much faster. We tested the time it took to RECALL ALL previously deleted records on

```
<ctrl-f10>      Begin macro definition
<alt-e>          Press Alt-E
<shift-f3>       Move to Doc 2
<none><none><down>  Go to end of document
<shift-f5>2      Set Date Format
<tab>#1/1/S<tab>#1<tab>
                (or the date/time format
                string of your choice)
<cr><cr>        End date/time format
<none>           Designate "End" (not the <End> key)
<shift-f5>1      Insert date/time
<shift-f5>2      Set date format
3<space>1,<space>4  Reset normal date format
<cr>
UP              Move cursor to first line of entry
<up>
<up>
<end>           Take user input to identify task
<shift-f3>       Back to Doc 1
<ctrl-f10>       End macro definition
```

```
_Keystrokes for ALT-S Macro_
<ctrl-f10>      Begin macro definition
<alt-s>          Press Alt-S
<shift-f3>       Go to Doc 2
<none><home><down>  Go to end of document
<shift-f5>2      Set date format
<tab>#1/1/S<tab>#1<tab>
                (or the date/time format
                string of your choice)
<cr><cr>        End Date/time format
ST              Designate "Start"
<shift-f5>1      Insert date/time
<shift-f5>2      Set Date Format
3<space>1,<space>4  Reset normal date format
<cr>
FT              Exit date function
<cr>
<shift-f3>       Move to new line
<ctrl-f10>       End macro definition

_Keystrokes for ALT-E Macro_
```

Figure 2: The keystrokes to create an append-style Alt-S macro (see Figure 1).

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two identical files, one of which was indexed and the other was not. It took 20 seconds for the unindexed file and 140 seconds for the other.—*Robert S. McConnell and Judith H. Walsh; Rockville, Maryland*

Unless a SCOPE expression is used, not only these *dBASE* commands but also COUNT, DELETE, COPY, and several others are affected. All of them start by going to the Top-Of-File and sequentially examining each record until the End-Of-File is reached. Naturally, this takes longer if an artificial sequence is imposed by the presence of an active index.

The time penalty increases in proportion to the length of the physical index key and, more important, to how much the index order varies from the physical sequence. A good way to observe the differences is to SORT a file on Zip code and LastName. Then create three indexes: one on Zip, the second on Zip+LastName, and the third on LastName alone. You'll find that to COUNT with the Zip index is almost as fast as the unindexed COUNT; the Zip+LastName index takes somewhat longer, and when you COUNT with the LastName index on, the disk thrashes madly as it jumps from one disk location to another trying to step through the index's unnatural sequence.

As an alternative to this suggestion of closing the index before issuing sequential commands, you might substitute the following command:

SET ORDER TO #

This suspends your index instead of closing it. The commands process just as quickly, and you don't lose the time taken to close and reopen the index.

If the database is very large and the records you want to process are related to the index key, you'll find that it's sometimes actually faster to leave the index on. Suppose, for example, that you want to

RECALL ALL FOR STATE="NJ"

and you have a Zip index. All New Jersey ZIP codes begin with 07 or 08. In such a case, the sequence

FIND #7

RECALL ALL WHILE STATE="NJ"

will yield the fastest results.—*Brad Stark*

Merge-printing addresses with different numbers of lines in Microsoft Word

When merge-printing form letters in *Microsoft Word*, it's a problem to keep *Word* from skipping a line in addresses that lack one or more variables (for example, addresses that lack company names). You can avoid these blank lines by using the If...Endif statement.

The general form of the statement is

IF fieldname* {text to print} *ENDIF

This tells *Word* that if the particular variable (the company name, for example) has any value at all, it should print the "text to print." If the variable has a null value (that is, no company name), *Word* will print nothing.

The secret to making this work is to include the fieldname itself plus a carriage return the text to print. Thus, this example avoids blank lines:

```
*Name*
*if title*{title}
*endif*{if company*{*Company*}
*endif*{if address1*{*address1*}
*endif*{if address2*{*address2*}
*endif*{if city*{*city*}
*state* *zip*
```

Notice that if there is no value for a given variable—the title, for example—the positioning of the Endif statement will tell *Word* to skip not only the title but also the carriage return that follows.—*Steve Buser; Covington, Louisiana*

The *Word* manual suggests a slightly different format, in which the Endif command is put on a line by itself, without the right chevron but with a hard carriage return at the end. If you follow *Word*'s official format, the first few lines of the address will look like this:

```
*Name*
*if title*{title}
*endif
*if company*{*Company*}
*endif
*if address1*{*address1*}
*endif
```

The absence of the right chevron on the Endif statement tells *Word* to continue to the next line as if there were no hard carriage return.

■ POWER USER

Unfortunately, both Mr. Buser's suggestion and the manual's recommendation lack readability. All the <<If . . . Endif>> statements clutter up the screen, making it hard to see the format of the document you are composing. Worse, the manual's approach makes it difficult to determine where your page breaks should go, since Word counts the Endif lines on-screen as real lines, even though they will not print during a merge. This makes Mr. Buser's suggestion preferable to the one in the manual.

A still better approach, using either format, is to take advantage of hidden text. If you set the Show Hidden Text choice to No under Window Options, then define the If and Endif statements as hidden, the address will show on-screen as

```
*name*
*tile*
*Company*
*address1*
*address2*
*city*, *state* *zip*
```

(Also present will be the double arrows Word uses to designate the locations for hidden text.) This will work with either format and is certainly far more readable than either alone. If you run into problems in printing, you can always change the Show Hidden Text option to Yes, to check your If statements.

The macro below will facilitate your work:

```
*ask variable=?What variable name=
*<enter>*left=y:center>
*<enter>*=endif*<enter>*left=x:center>
*variable*=<enter>*<enter>*left=y:<enter>
*endif*<enter>*<enter>*left=x:<enter>
```

This macro will ask you for the variable name, write the If statement for you, and define the appropriate sections as hidden text.—M. David Stone

Using CHR(13) to force blank lines in dBASE .LBL outputs

The dBASE label writer does not print lines that evaluate to blanks. This occurs if a line is left blank in the .LBL form or if the field(s) specified on a given line have no data. This is usually what you want, since unintended blank lines look unnatural. But it will cause problems when you do want to leave a blank line in a label.



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LANGUAGES

Locate the total amount of installed RAM with this simple technique; an easy method to display colors on a screen; CURSOR.PAS shows how to set the cursor in Turbo Pascal.

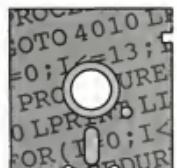
A Turbo Pascal program to display additional lines and columns

There are some situations in which the standard IBM PC video screen (80 by 25) is not big enough to display all the information we want to show on a single screen—for example, when you need to display a summary table, a correlation matrix, etc. In those situations, you may wish you could have a monitor that can display 150 columns and 40 or 50 lines.

One way out of this limitation is to create a virtual screen. The virtual screen can hold all the information you want and at any time display a part of it on the video

monitor. Your screen just becomes a "viewport" into the virtual screen that you can drag around using the arrow keys, as shown in Figure 1. The program listing in Figure 2 provides the basic procedures to do just that.

The Big_ClrScr routine is similar to the Turbo Pascal built-in function ClrScr. It clears the entire virtual screen (not the monitor screen). The Big_Write procedure puts the text given in the first parameter on the virtual screen. The three next parameters specify the position on the screen (Col, Row) and the video attribute of the text (VidAtt). The Show_BigScreen routine moves a part of the virtual screen on the video monitor. The two parameters speci-



Display Screen as Viewport



Figure 1: A visual representation of the video monitor as a viewport into a larger virtual screen.

```
PROGRAM Bigger_Screen;
USES CRT, VIDEOT;
{This can relocate the lines above for use in Turbo Pascal 3.0. The
program works as is in TPI.}
CONST
  Wide = 150; { You can adjust the size of the virtual screen }
  Long = 25; { by changing these two constants
  } { Change to 24 if your monitor displays only 24 lines }
  Blanks = 50;

TYPE
  Scr = ABSOLUTE BARRY[1..Blanks, 1..#0, 1..3],OF Char;
  LongString = STRING[255];
  VAR
    Mode : Scr ABSOLUTE $0000 : $0000;
    Color : Scr ABSOLUTE $0000 : $0000;
    VidAtt : Byte ABSOLUTE $0000 : $0000; { video mode }
    BigScr : ARRAY[1..Long, 1..Wide, 1..3] OF Char;

  PROCEDURE Big_ClrScr;
  VAR I : Integer;
  BEGIN
    FOR I := 1 TO Wide DO
      BEGIN
        BigScr[1, I, 1] := Chr(32);
        BigScr[1, I, 2] := Chr(15);
        END;
    FOR I := 2 TO Long DO
      BEGIN
        BigScr[I, 1, 1] := Chr(32);
        BigScr[I, 1, 2] := Chr(15);
        END;
  END;

  PROCEDURE Big_Write(Line : LongString; Col, Row : Integer; VidAtt : Byte);
  VAR I : Integer;
  BEGIN
    IF (Row <= Long) THEN
```

```
    FOR I := 0 TO Length(Line)-1 DO
      IF (Col+I) <= Wide THEN
        BEGIN
          BigScr[Row, Col+I, 1] := Line[I+1];
          BigScr[Row, Col+I, 2] := Chr(VidAtt);
        END;
    END;
  END;

  PROCEDURE Show_BigScreen(PosX,PosY : Integer);
  VAR I : Integer;
  BEGIN
    FOR I := 1 TO Wide DO
      CASE Mode OF
        7 : Move(BigScr[i+PosI-1, PosY, 1], Mem0[I, 1, 1], 148);
        2, 3 : Move(BigScr[i+PosI-1, PosY, 1], Mem0[I, 1, 1], 148);
        ELSE
      END;
  END;

  PROCEDURE GetScreen;
  VAR
    Ch1, Ch2 : Char;
    PosX, PosY : Integer;
  BEGIN
    PosX := 1; PosY := 1;
    Ch1 := Ch2 := #27;
    REPEAT
      Show_BigScreen(PosX, PosY);
      Read(Xd, Ch1);
      Read(Yd, Ch2);
      IF Ch1 = Chr(27) THEN
        BEGIN
          Read(Xd, Ch2);
          CASE Ord(Ch2) OF
            72 : IF PosY > 1 THEN PosY := Pred(PosY); { (up)
            } { (continues)
```

Figure 2: A program demonstrating a virtual screen larger than the monitor.

■ LANGUAGES

```

77 : IF Port < Wide-79 THEN Port := Hacc(Port); (right)
88 : IF Port < Wide+(Wide*16) THEN
      Port := Hacc(Port);
95 : IF Port > 1 THEN Port := Prod(Port); (down )
      Port := Prod(Port);
102 : (left )
110 : (up )
117 : (right )
124 : (left )
125 : (right )
126 : (up )
127 : (down )

```

```

131 : Write('← this is the upper left corner of the screen');
132 : (white);
133 : Write('↑ arrow keys to move the "viewport"; press <return> to quit');
134 : (1, 2, white);
135 : Write('← this is the middle of the screen');
136 : (1, 2, black);
137 : Write('↓ is the lower right corner of the screen →');
138 : (1, 2, black);
139 : Write('←');
140 : Getchar();
141 : End;

```

(Figure 2 cont'd)

fy the upper-left corner of the window on the virtual screen. This procedure is called by the GetMove procedure that waits for a key from the keyboard. If you press an arrow key, the viewport moves in that direction.—Normand Peladeau; Montreal, Quebec, Canada

Be warned—this program will cause ugly "snow" on a standard IBM CGA. Accessing the video RAM directly while the electron beam is writing to the screen causes this snow. If you adopt this technique, you will need a procedure to access video RAM during the retrace interval, when the electron beam is sweeping back for the next scan line. Almost every library of Turbo Pascal routines includes such a procedure. In addition, the procedure ShowBigScr checks the video mode by directly examining a byte in the BIOS data area. This technique generally works, but it is safer for you to simply query the video interrupt, as in the program listing VIDMODE.PAS that is shown in Figure 4.

—Neil J. Rubenking

A simple method that sets the cursor shape in Turbo Pascal

Many programs that modify the cursor will return the cursor as a dash instead of an underline when run on a monochrome system. This happens when the program saves the original cursor shape and resets it to that shape when it's done.

A simple solution to this problem is to set the cursor manually before running any cursor-modifying programs. Doing so also corrects the cursor scan line numbers that are stored in memory. The program shown in Figure 3 does just this if run with no parameters. It first checks to see that a monochrome board is in use. You can include the program in your AUTOEXEC.BAT file if you like. If you call it with two parameters, it will set the cursor's top scan line to the first and the bottom to the second. Creative parameter juggling can yield cursors that look like blocks, or underbars, or even double blocks. You can change the cursor to let the user know what is going

on, for example, whether he is in insert or overwrite mode. (Note: Figure 3 was written in Turbo Pascal 3.0. To convert it to 4.0, use the compiler's UPGRADE.EXE utility.)

One interesting quirk I've discovered is that while many parameter sets simply yield no cursor, others such as

CURSOR 100 105

give a cursor that looks normal but blinks very slowly.—Eric Woodhouse; Mill Valley, California

The parameter set

CURSOR 0 12

would set a full block on a monochrome monitor. For a CGA, you'd use

CURSOR 6 7

The slow-blinking or erratic cursor is a phenomenon of the monochrome monitor only. Note that this program uses a somewhat chancy method of checking the current video mode. It looks at the BIOS

```

{SR}
PROGRAM Cursor;
VAR
  I, J, B : Integer;
  Equipment_Flag : Integer ABSOLUTE $4B:$1B;

PROCEDURE Set_Cursor(Top, Bottom : Byte);
TYPE
  Registers = Record
    Integer OF
    1 : ( AX,BB,CB,OB,BF,BI,D1,D6,BS,Flags : Integer );
    2 : ( AL,AM,BB,CL,CH,DL,DE : Byte );
  END;
BEGIN
  VAR
    Repack : Registers;
  BEGIN
    Repack.AH := 1;
    Repack.CL := Top;
    Repack.CL := Bottom;
    Intr($10, Repack); {call interrupt}
    {Set_Cursor}
  END;
END;

```

```

  WriteLn('Uses 2 numeric parameters (to set ', 
         'cursor top and bottom, e.g. "Cursor 2 18").');
  END;
  ELSE
    Val(ParamStr(1), I, B);
    If I < 0 THEN
      BEGIN
        Write('Parameters must be numeric! ');
        WriteLn(ParamStr(1), ' is not. ');
        Halt;
      END;
    Val(ParamStr(2), J, B);
    If J < 0 THEN
      BEGIN
        Write('Parameters must be numeric! ');
        WriteLn(ParamStr(2), ' is not. ');
        Halt;
      END;
    set_Cursor(I, J);
  END;
  ELSE
    BEGIN
      WriteLn('Call program either with no ', 
             'parameters (for reset to MODO startup cursor)');
      WriteLn('or with 2 numeric parameters (to set ', 
             'cursor top and bottom, e.g. "Cursor 2 18").');
    END;
  END;
  END;

```

Figure 3: The program CURSOR.PAS lets you set the cursor shape in Turbo Pascal.

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■ LANGUAGES

```
(SR*)
PROGRAM VidModeDemo;
VAR
  VidMode : Byte;
  FUNCTION VideoMode : Byte;
  COM88
    BIOSVideo := $18;           (* Bios Video Services Interrupt *)
    GetVideoMode := $0F;        (* Bios Request for Get Video Mode *)
  TYPE
    REGRec = RECORD
      AX, BX, CX, DX : Integer;
      SP, SI, DI : Integer;
      DS, ES, FS, GS : Integer;
      Flags : Byte;
    END;
  VAR
    Registers : REGRec;
  BEGIN
    Registers.AX := GetVideoMode + $0F;
    Interv($10, Registers, Registers);
    VideoMode := Lo(Registers.AX);
  END;
  END;
  VidMode := VideoMode;
  IF VidMode = 7 THEN
    Writeln('Using MONOCHROME monitor, 80x25 TEXT mode');
  ELSE
    E8C8
    Writeln('Using color/graphics monitor, ');
    CASE VidMode OF
      0..4 : Writeln('480x25 black-and-white TEXT mode');
      1 : Writeln('480x25 color TEXT mode');
      2 : Writeln('800x25 black-and-white TEXT mode');
      3 : Writeln('800x25 color TEXT mode');
      4..6 : Writeln('CGA graphics mode ', VidMode);
      8..10 : Writeln('PCjr graphics mode ', VidMode);
      11..12 : Writeln('UNKNOWN graphics mode ', VidMode);
      13..16 : Writeln('EGA graphics mode ', VidMode);
    END;
  END;
END;
```

Figure 4: The program listing for VIDMODE.PAS is a routine to check the current video mode.

Equipment Flag for the monitor currently in use. In general, you should query the video interrupt to get the current mode, as in the listing VIDMODE.PAS in Figure 4.

—Neil J. Rubenking

A program to display different colors on the screen in Turbo Pascal

I like to put a lot of color in the screen output of my Turbo Pascal programs, and I know I'm not alone. This goes for text as well as graphics. Highlighting the text with various colors is a big help for readability and appearance. However, not everyone has the equipment for color, and since I like to share my programs, it's a good idea for the programs to adapt to whatever display is in use.

I could ask the users if they want color, but I like to make my programs smarter than that. Most of my programs make use of a BIOS Video Services Interrupt called Get Video Mode. Interrupt 10h controls the BIOS video services. The service requested goes in the AH register (0Fh for

the Get Video Mode service). The current video mode comes back in the AL register after the interrupt finishes.

I've included a program (Figure 4) as an illustration. If you have a CGA or EGA, try executing the command

MODE CO88

and run the program. It should tell you that you're in a color text mode. Then try

MODE BW80

and run the program again. You may also have noticed that Turbo Pascal does something similar in the "default display mode." (Note: Figure 4 was written in Turbo Pascal 3.0. To convert it to 4.0, use the compiler's UPGRADE.EXE utility.)

One important application might be to see if the user has a monochrome adapter (video mode 7) before doing any graphics output.—Becki Allen; Canby, Oregon

Do note that this program cannot detect whether you have a color monitor or a black-and-white composite monitor attached to the color/graphics adapter. This

isn't a limitation of the program—it's just not possible to determine from software. If you use a color mode and the monitor is not able to display color, your beautiful screens may become illegible. Suppose that you have printed a warning message in red on blue—if the monitor's shades for red and blue are similar, the message will be illegible. My own solution to this problem has been to let the user specify a command line option "/BW" to force BW mode. —Neil J. Rubenking

Locating the total amount of installed RAM in Turbo Pascal

It can be handy for your program to know how much memory its host computer has. When an application may run on a variety of different hardware, you can use this information to set up a balance of memory and disk-based storage. The function MemSize included in Figure 5, which was written in Turbo Pascal 3.0, calls interrupt \$12 to get that information. The number returned by MemSize is the amount of

```
(SR*)
PROGRAM MemsizeTest;
FUNCTION Memsize : Integer;
TYPE
  Regs = RECORD
    AX,BE,CX,DX,BP,SI,DI,DS,ES,FS,GS : DWord;
    DS : Word;
  END;
  VAR
    Registers : Regs;
  BEGIN
    Interv($12, Registers);
    Memsize := Registers.AX;
    Registers.DS := $0000;
  END;
  FUNCTION Memavail : Integer;
  BEGIN
    { We multiply the high and low bytes of memavail;
    | separately in order to avoid problems when its
    | value is > 32767. Turbo will treat an integer
    | > 32767 as a negative number, but bytes are
    | always positive. }
    MSHCH
    Memavail := Trunc((Hi(Memavail)*256+Bc(Memavail))/64.8);
  END;
  END;
  Writeln('TOTAL RAM installed is ', Memsize, 'K');
  Writeln('TOTAL RAM available within this program is ', Memavail, 'K');
END.
```

Figure 5: A program that checks the TOTAL amount of installed RAM.

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Xtreive is multi-lingual also. It includes more than 20 language interfaces (including C, BASIC, PASCAL, FORTRAN). However if it turns out that you are using something a little unusual, worry not. The manual includes a chapter on how to write your own interface to Btreeve.

Btreeve's vital statistics are equally impressive. Files may have up to 4096 indexes, fixed record length to 4096 characters, variable length to 64K, indexes to 255 characters, files of 4 billion bytes. Network support includes Novell, VMS, IBM PC NET, Software Link's MultiLinkTM and DECnetTM.

XQL is a relational database management system designed especially for programmers. Imagine being able to access your database with the ease of SQL (Structured Query Language) statements and still having the power to process that data right down to the byte level.

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The XQL system works in tandem with Btreeve and Xtreive. It is a menu-driven, disk retrieval system, that allows you to quickly find information and display reports. System developers can easily customize Xtreive to display command menu, help files, and error messages in the English spoken by the customer. Xtreive also includes a menu editor that users can quickly recognize, making Xtreive an easy product to use and understand.

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■ LANGUAGES

memory installed in the system, not the amount of free RAM.—*Kevin King, Sheridan, Wyoming*

Turbo's own MemAvail function tells how many 16-byte paragraphs of RAM your program can use beyond its basic code and data requirements. If your program needs a lot of RAM, you can check what's available with a function like KAval in Figure 5. Using MemSize, you can deliver an intelligent message if KAval shows too little RAM: for example, "This program needs 400K to run. You have 640K installed, but only 200K of it is available to me. Please remove some RAM-resident programs and try again." (Note: In order to convert Figure 5 to Turbo Pascal 4.0, use the compiler's UPGRADE.EXE utility.)—*Neil J. Rubenking*

Productivity Tip

In Turbo Pascal 3.0 or 4.0, open UNtyped files with a block size of 1. You do this by adding an optional parameter t/Rewrite, for example, "Reset(F,1);". This allows you to BlockRead/Write exactly the number of bytes in the file without rounding that number to the size of the block.

Productivity Tip

There's a particularly nasty bug in QuickBASIC 3.0 that causes some programs to crash. If a program calls assembler routines and it is compiled to a BCOM file from within the editor, a faulty .OBJ module will be created. One solution is to always compile from DOS, but the best move is to trade up to QuickBASIC 4.0.

Speak Your Language

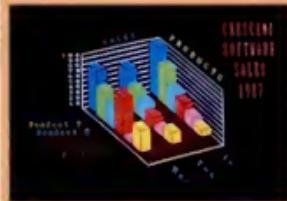
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■ ROBERT L. HUMMEL

PC TUTOR

Hiding game programs using ATTR.COM; how a bad track can render good sectors useless; using MORE to read and write text one screen at a time.

Why using COBOL on a PC workstation makes sense for program development

It's fascinating how the mere mention of the word "COBOL" can bring smirks to the faces of most PC users. Programmers and nonprogrammers alike condemn and ridicule COBOL as antiquated and verbose. They think of it as an ancient language for mainframes and shrug off any serious consideration of using it when they need to develop new applications. So I was tempted to start off my review of Microsoft's new COBOL Optimizing Compiler, Version 3.0, on a defensive note—but it wasn't necessary.

COBOL (Common Business-Oriented Language) is a data manipulation language usually associated with business and database applications for mainframes and minicomputers. (It can be compared loosely with the dBASE programming language on the PC in terms of its application.) Because the language was developed and has been in continuous use since 1960, programs written in COBOL account for more lines of code than all other computer languages combined. In addition, a version of COBOL is implemented on almost every mainframe and minicomputer, exceeding even C in terms of portability.

Large applications written in COBOL often have lifetimes that are measured in years, or even decades. When the average COBOL program is employed longer than the average COBOL programmer, maintenance and ease-of-modification become

key considerations. For this reason, many MIS/DP shops standardized on COBOL long ago and have a significant financial investment in the language.

Well known for its English-like syntax, a COBOL program can be easy to understand and nearly self-documenting. Contrast this to other popular programming languages, like C and Pascal, that use terse and often cryptic expressions. This property serves two very important functions. It allows new programmers to understand and maintain existing code very easily. It also allows nonprogrammers to get some sense of what the programming is doing. This is important for MIS managers who, while not programmers, are nonetheless responsible for the overall programming effort. For example, consider how easy it is to understand the following COBOL statement:

SUBTRACT COST FROM SALES GIVING PROFIT

Implementing COBOL on a PC has several clear advantages for MIS/DP departments and large corporations. Programmers using COBOL on a department mainframe or minicomputer can move to the PC without having to be retrained in a new "alien" language. Proven and debugged programs running on the main system can be recompiled and run immediately on PCs. And new programs that are developed will function in both environments. COBOL applications now being sold for use on mainframes and minicomputers can be moved to PCs by recompiling. Thus with little effort, new marketing opportunities can be created.

A compatible COBOL development on a PC can also save time and money when developing for other systems. For example, prototypes of new applications first can be developed on a PC and then can be demonstrated easily using a laptop or portable PC. Conversely, applications could be developed on a mainframe and then distributed for use on PCs. By training new programmers on PCs instead of the corporate mainframe, in-house training costs can be reduced while effectiveness is increased. Classrooms and training sites can be set up without regard to their proximity to the mainframe or network location. Finally, a PC-based COBOL development workstation may offer significant cost savings for departmental computing and remote sites.

TYPE doesn't have an option to pause the output while reading a file, but MORE solves the problem nicely

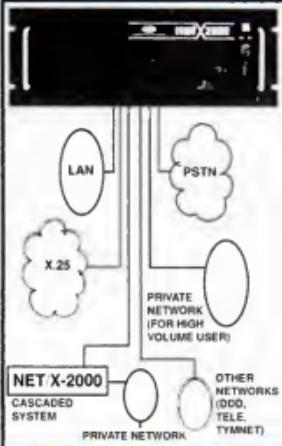
I'm having some problems with the TYPE command. I want to display the contents of a disk file on the screen one page at a time and then send that screen to the printer using the Print Screen function. Although logical, I find that the following command fails:

TYPE /P filename

If I omit the /P (for pause), the file is displayed but scrolls continuously and can be stopped only by using the Pause key. Then, desiring a printed copy, I press Print



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■ PC TUTOR

Screen. But instead of printing, the key-press resets the scrolling!

I know that I can use the command

TYPE filename > PRN

to send a copy to the printer, but then I can't read it on the screen at the same time. It appears that the DOS programmers overlooked this obvious option.—*M. Steve Hajek, Woodbridge, Virginia*

Unlike the DIR command, where adding the /P option will cause DOS to pause after displaying 23 lines, the TYPE command insists on displaying the entire file. This is easier to understand if you think of the command

TYPE filename

as a shorthand version of the command

COPY filename CON

where CON is the logical name for the screen.

The effect you wish, however, can be achieved by using another program supplied with DOS: MORE.COM. The MORE program is designed to read from standard input and write to standard output 23 lines at a time. To view a file one screen at a time while pausing to allow reading and printing, simply execute the following command:

MORE < filename

MORE is an external command, so the file MORE.COM must be either in your current directory or in a directory pointed to by the PATH command. The less-than sign (<) tells MORE to read its input from *filename*.

Be warned! Reversing the symbol from < to > will cause MORE to read from the keyboard and write to the file. This will quickly and quietly destroy the data in the file. I feel that this is too serious a mistake to trust to a slip of the fingers. For this reason, I recommend that you create a batch file called PAGE.BAT that contains the single line

MORE < &1

Now, to read a file, pausing every 23 lines, simply type

PAGE filename

Productivity Tip

New owners of personal computers often ask their friends, experts, and *PC Magazine* what program is the best in its category. But rarely do they ask what's the most important program they can own. For computer users whose machines have a hard disk, the answer is simple: a backup program.

No single event will create more despair and result in more wasted effort than accidentally erasing a needed file. There's no excuse for not backing up your data every day. Many fine commercial programs are available, but if you can't afford one, one is provided for you free of charge: a backup program is included free on your DOS disk.

Concealing game programs from the boss is easy using the ATTR program to hide directories

Help! I've placed some antistress programs (*Flight Simulator*, for example) on my hard disk so when the boss is away, this mouse can play. How can I place the games in a directory in such a way that when the boss looks at the directory, he won't see them?—*Timid Mouse, Yellowknife, Northwest Territories, Canada*

Dear Timid Mouse: I've omitted your name in case your boss reads PC Tutor. After all, there's no point giving him a head start, is there? To hide your game programs so no one can access them but you, just follow these simple steps.

First, you'll need a program that can change the attributes of a file. The best solution is to obtain a copy of the *PC Magazine* ATTR.COM utility. (A ready-to-run version is available from our on-line service, PC MagNet. Instructions for accessing PC MagNet are given in each issue's Utilities column.) Next, create a subdirectory with a name that's difficult to guess. (Hint: don't use GAMES.) Try using a random mix of letters and numbers or even adding an extension to the directory name. Copy all your games into that subdirectory. Finally, make the directory invisible by hiding it with ATTR.

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PRODUCTIVITY

■ PC TUTOR

The following commands will create a hidden directory named SEMAG (GAMES backwards) on the C: drive and hide it:

```
C:  
CD \  
MD SEMAG  
ATTR +H SEMAG
```

While the directory will not appear in a DIR listing, other DOS commands will continue to function normally. If you had a game called CHECKERS, you could play using the following commands:

```
C:  
CD \SEMAG  
CHECKERS
```

Unless the boss is counting files carefully or using a disk-snapping program like PC Tools, we'll keep the games on your hard disk our little secret.

A bad track on a hard disk will cause some good sectors to become unusable

In the July 1988 PC Tutor column, your discussion of a hard disk's bad tracks left one thing unclear. Because clusters made up of 4 sectors do not fit perfectly on a 17-sector track, some clusters must be split across two tracks. What does the DOS FORMAT program do when part of a cluster lands on a track that was marked bad by the low-level formatter? Is there a fixed relationship between cluster addresses and physical addresses such that a few sectors on the good track have to go unused because the whole cluster must be marked bad? This would mean that CHDKSK would show 10240 bytes in bad sectors for one bad track. Or can FORMAT make use of all the good sectors, even if this means that one cluster would contain noncontiguous sectors before and after the bad track?

—Robert J. Sandler; New Milford, New Jersey

The BIOS disk services use three coordinates to determine the location of a physical disk sector: head (side), cylinder (track), and sector. DOS, on the other hand, need not be concerned with the physical parameters of the disk and uses a single coordinate: the logical sector num-

ber. Logical sector numbers are assigned starting with 0 and are translated to physical disk coordinates by the BIOS.

A cluster is simply a group of sectors that are treated by DOS as a single unit of disk storage space. When the disk parameters are being calculated by the FDISK program, the only allowable cluster sizes are integer powers of two. Typical cluster sizes would be 2, 4, and 8 sectors.

For standard hard disks, tracks are created that contain 17 sectors. (RLL disks typically use 31 sectors per track and thus have greater capacity.) A whole number of clusters will not fit onto one track evenly but will cross the boundary between heads and/or cylinders. This only becomes significant when a track is marked bad during the low-level format.

Assuming a cluster size of 4 sectors is in use, a single track will hold all or part of 5 clusters. The layout of the clusters on the track isn't important. Four different arrangements are possible and can be illustrated as follows:

```
AAAAABBBBCCCCDDDDDE  
AAABBBBBCCCCDDDDDEEE  
AABBBBCCCCDDDDDEEE  
ABBBBCCCCDDDDDEEEE
```

where each letter represents a sector belonging to a particular cluster.

If a track is marked bad during the low-level format, DOS will mark all 5 clusters that would have used that track as unusable. This will even lock out the portions of clusters that fall on good tracks. Thus, a single bad track will cause 5 clusters to be marked as bad, locking out 10240 bytes. On my hard disk, for example, with four bad tracks, CHDKSK reports 40960 bytes in bad sectors.

Ask the PC Tutor

The PC Tutor solves practical problems and explains points of general interest about using your hardware and software more productively, and answers basic questions about DOS and systems in general. To see your questions answered here, drop a line to PC Tutor, PC Magazine, One Park Avenue, New York, NY 10016. We're sorry, but we cannot answer questions personally.

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CONNECTIVITY CLINIC



Manipulating environment variables in DOS 3.3; avoiding micro-to-mainframe file transfer failure; preventing unwanted keystrokes from jamming a network.

Prevent unwanted keystrokes from jamming your network

In your May 31, 1988, Connectivity Clinic, David H. Lipman offered a way to suppress the Ctrl-PrtSc function.

This is often an important problem. When we designed an exhibit for the general public, it was vital to inhibit Ctrl-Alt-Del, Ctrl-Break, Ctrl-PrtSc, Shift-PrtSc, and several other key combinations with which people could cause us grief. We worked hard to find a bulletproof method and succeeded pretty well, but we never did find a way to guard against someone who simply raked his or her hands across the keyboard repeatedly, overwhelming the computer with keystrokes.

Mr. Lipman's solution is both too simple and too complex. It's too complex because creating an assembly language program isn't something everybody knows how to do. The whole job, at least as he has described it, can be done more simply by a single line in an AUTOEXEC.BAT file.

His solution is also too simple in that it causes some unnecessary ugliness on the screen or else may actually cause disaster!

His method for dealing with the problem causes DOS to attempt to interpret and execute his "error message." If the first word is not a valid filename or command, it will, as he notes, cause the message "Bad command or filename." But if the first word should happen to be that of an executable or batch file in the current directory or in the path, COMMAND.COM will in fact load it and allow it to run. De-

pending on what that program does, this could be disastrous.

A simple modification of the string sent to ANSI.SYS will eliminate this potential problem. Put the string

```
ECHO ESC[8;114;"Your message ";27;13p
```

in the AUTOEXEC.BAT file of the PC or workstation that needs protection. Although this string shows the escape character as ESC, it should be an actual escape character (ASCII value = 27). You can do this by editing the AUTOEXEC.BAT file using EDLIN, PC-Write, WordStar, or any other editor that allows insertion of control characters. It cannot be done, however, using the simple DOS command COPY CON.

In addition to the difference between using straight ASCII code in AUTOEXEC.BAT and creating, loading, and running a program, this string makes two more alterations to Mr. Lipman's solution. First, I added one or more spaces at the end of the message for clarity; second, I added the ASCII code for an escape character before the carriage return.

When this line is encountered in the execution of the AUTOEXEC.BAT file, it will cause the Ctrl-PrtSc key combination to be redefined to the error message followed by a space and then an escape character. However, this will only be true if you install ANSISYS in CONFIG.SYS.

The effect of this is that when the key combination in question is pressed at the DOS prompt, the error message will appear on the screen followed by a blank line and then a new DOS prompt.

The reason for this is that the escape character is interpreted by COMMAND.COM as a signal to ignore all the preceding characters on that line. COMMAND.COM lets us know that it has done so by putting the backslash character on that line and jumping to the start of the next line. The final carriage return in the error message ends the current command (now a null string) and causes COMMAND.COM to issue a new prompt.—John M. Goodman; Westminster, California

Sometimes it's important to disable Shift-PrtSc on a network to prevent lockups or unwanted printer activity. This tip works well on several different clones running different OEM versions of MS-DOS. But remember to load ANSI.SYS in the CONFIG.SYS file.

A simple fix avoids the most frequent cause of PC-to-mainframe file transfer failure

We are gearing up to run a series of LAN gateway tests for an upcoming article in the features section of *PC Magazine*. There are nearly two dozen companies involved in the tests. A couple of them have told us about a problem that is easy to avoid but that trips up many people attempting micro-to-mainframe file transfers.

I asked Steve Balogh, a technical support specialist at ITI in Scottsdale, Arizona, to write up a description of the problem and its solution. While ITI specializes in

■ CONNECTIVITY CLINIC

LAN gateway products, Steve says this is a potential problem not only for users transferring files from PCs to mainframes, but also for people using 3270 terminal emulation on standalone PCs too.

The most frequent cause of file transfer failure is improper setting of the "File Transfer Aid" bit on the IBM 3174 communications controller. This problem frustrates many people because the file transfer

package will start initializing the host system and then stop the procedure for no apparent reason.

Often, if the file transfer package allows you to hotkey back to the host session, you can "step" the file transfer through by hitting any key on the keyboard.

Option number 125 on the IBM 3174 Miscellaneous Features Options table enables the file transfer aid feature. You can check to see if the option is set by using the following procedure:

- Depress the TEST key on the 3278 emulator
- Hit ENTER
- Type 2 and ENTER
- Type 2 and ENTER
- Look for the ASCII character 125 followed by a string of zeros and ones on the screen. If you can't see it, depress PF8 to page forward.

■ Depress TEST to exit

IBM added this option for terminal emulators using a file transfer method, such as their own SEND/RECEIVE, that doesn't follow the usual controller-to-device procedures. Although the usual procedures are terrific for handling individual keystrokes (3270 scan codes, for example), they are inefficient for large data streams. The file transfer aid, on the other hand, lets the file transfer program write to the 3270 device control buffer. This procedure does work well, but only if you have chosen the correct option on the IBM 3174 Miscellaneous Features Option table.

—Steve Balogh



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Keep a copy of your order and all other correspondence with the Seller. Your records should include the company's name, address and phone number; a description of the item ordered; your cancelled check or a copy of the money order; record of the date you mailed the order; and any sales slips and shipping receipts.

When ordering by phone:

Note the time and date of your conversation and the name of the person you talk with;

Make a record of your order, the price, its promised availability and the components to be expected;

Save all correspondence associated with your order, including your cancelled check or a copy of the money order, and any written confirmation sent by the Seller.

Questions you should consider asking:

Does the advertised item come with all necessary parts and accessories? Are they from the same manufacturer?

Is it available for immediate shipping? If not, when will

it be available?

Has there been an increase in the advertised price?

What warranties does the item carry? Who provides the service?

What is the Seller's return policy?

What is the Seller's refund policy?

With whom should you correspond if there is a problem?

IF YOU HAVE PROBLEMS:

1. If you have not received your order as promised or if the item is defective, immediately notify the Seller in writing referring to your order by description, price, date, as well as by account number and order number, if available. Make sure you keep a copy of the letter.
2. If you complain by telephone, send a follow-up letter to confirm what was said.
3. If you think the merchandise is defective, reread your product instructions and your warranty carefully to be sure you don't expect features or performance the product isn't designed to give. Then contact the Seller for instructions. Don't return it to the Seller until you have been instructed to do so.
4. When returning merchandise make sure you keep the shipper's receipt or packing slip; your right to be reimbursed for postal cost is determined by store policy.
5. If you have completely discussed your problem with the Seller and are still not satisfied, write to the consumer complaint agency in the Seller's state. If you paid for the merchandise by credit card, you may have rights to withhold payment under a Federal law called the Fair Credit Billing Act.

■ CONNECTIVITY CLINIC

You can safely manipulate environment variables in DOS 3.3

In the March 15, 1988, Connectivity Clinic, you explained how to use the commands **COMMAND /C filename** and **CALL filename** in DOS 3.3 to call other batch files as subroutines. This may have limited the options of some of your readers. You stated that "batch files called as subroutines may read the environment strings but should not set or change any of the strings," because the changes would be made to a second copy of the environment that is loaded with the secondary copy of **COMMAND.COM**.

While this is accurate when using the **COMMAND /C** method of calling a batch file subroutine, the **CALL filename** batch file command does not load a secondary copy of **COMMAND.COM**, and the environment variables may be safely manipulated in the CALLED batch file. I have found this and other features of DOS 3.3 extremely useful, especially in a LAN environment, and would strongly encourage any other LAN manager to consider changing over to DOS 3.3.—*Jack Motz; Fairview Park, Ohio*

Our earlier advice did relate to the **COMMAND /C** technique used before DOS 3.3, but the distinction is valuable. We agree that DOS 3.3 is the way to go and, indeed, the latest versions of several LAN operating systems require it.

Productivity Tip

FASTOPEN is a DOS 3.3 command used by a few LAN operating systems, specifically IBM's PC LAN, to improve performance. The **FASTOPEN** command causes DOS to cache filenames for faster response. Users of DOS-based operating systems (10-NET, Network-OS, ViaNet, etc.) will benefit from including **FASTOPEN** in their server's AUTOEXEC file.

Network Your Questions

Connectivity Clinic gives you practical solutions to networking problems of all

types. We'll pay \$50 or more for any tips we print, plus an extra \$25 if you submit your letter on a disk, and we'll gladly answer any questions you have, at no charge.

Mail your contributions to Connectivity

Clinic, *PC Magazine*, One Park Avenue, New York, NY 10016, or you may contact Frank J. Derfler, Jr., via MCI Mail (be sure to use Derfler's box named CONNECTIVITY CLINIC). 

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In fact, in recent interviews with our subscribers, we learned that 70% bought PC products and services through direct marketing channels during the past year.*

You buy direct because it's convenient, because you know exactly what you want and don't need any hand-holding.



The following special section, PC Magazine's Direct Marketing Connection, is what you've been demanding. It connects you with the direct marketers who are anxious to please you. By having them all in one place, you can quickly zero in on the products you need from the vendors you want to buy through.



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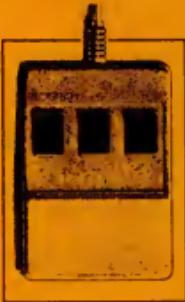
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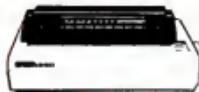
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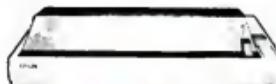


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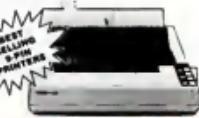


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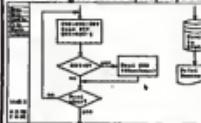
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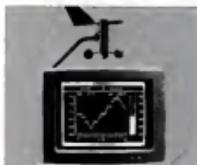
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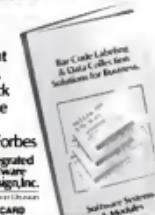
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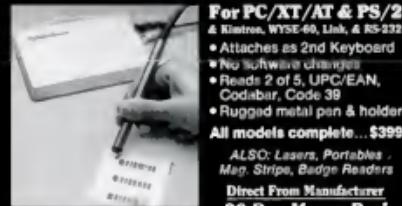
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1. In which of the following sectors does your organization operate? (Check one.)

- a. ☐ Private Industry
- b. ☐ Government
- c. ☐ Education

2. Your primary job function is (check one):

- d. ☐ MIS/DP, Communications Systems, Programming
- e. ☐ Engineering/R&D
- f. ☐ Finance/Accounting
- g. ☐ Marketing/Sales
- h. ☐ Administrative/General Management

3. Is your company a reseller?

- Yes
- No

4. For how many IBM PCs and compatibles do you specify brands of products?

- 10 or less
- 11-25
- 26-100
- 100 or more

5. Are there any PCs in your office? (Check off all that apply.)

- ☐ Linked to mainframe
- ☐ Linked to mini
- ☐ Networked together

6. Does your company own

- ☐ Mainframe(s)
- ☐ Mini(s)

7. Do you plan to buy any PC products?

- ☐ Now
- ☐ In 4 to 6 months
- ☐ In 6 to 12 months
- ☐ No definite plans

8. Number of employees in your entire company?

- ☐ 25 or less
- ☐ 26-29
- ☐ 100-499
- ☐ 500-999
- ☐ 1000 or more

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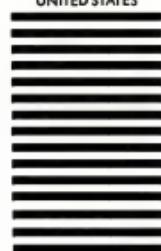
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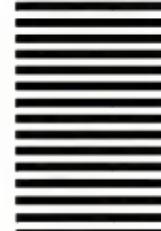
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COMING UP

MIND MIRRORS Are they time organizers, text databases, people trackers, or computerized secretaries? The broad category of organizational software has widened to include a large group of data handlers with diverse features, from simply recording phone numbers to making associations and even assigning priorities in your everyday activities. Together, these products compose the still-evolving genre of personal information managers. Our reviewers define the differences, helping you make the move to the organized side of life. Among the 25 programs evaluated, you're sure to find at least one that works the way you do.

NEW BREED The company that brought us DOS on the road has just played a trump card with its release of the Compaq SLT/286. The first laptop computer to boast VGA graphics resolution, the SLT also sports the longest-lasting battery of any 286-based hard disk-equipped laptop. Executive editor Gus Venditto puts this traveler through its paces.

ENVELOPES WITH EASE Put the ballpoint pen away and enjoy the macro-language convenience of the computer age. *PC Magazine* answers the question users of the HP LaserJet have been asking from the beginning: how to get their printer to handle envelopes. Contributing editor Edward Mendelson reviews six envelope-addressing programs and offers macros for the major word-processing programs that tell your printer all it needs to know to print envelopes.

WORKGROUP PRODUCTIVITY Our discussion of the cooperation between personal and mainframe computers continues, with the second part of *PC Magazine's* feature on LAN gateways. Here, workgroup systems editor Frank J. Derfler, Jr., examines 10 products that function on existing network systems, from Attachmate, Digital Communications Associates, Eicon Technology, Gateway Communications, IBM, ICOT, Information Technologies, National Advanced Systems, and 3Com.

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AFTER HOURS



Resume Kit Provides The Help You Need to Get the Job You Want

BY DONALD B. TRIVETTE

A good resume can be the key that opens the door to success in business. As most job hunters know, this is the place to showcase your talents, skills, education, and experience. The \$39.95 *Resume Kit*, from Spinaker Software, makes writing a resume almost as easy as filling in the blanks.

Resume Kit is more than a fancy word processor—it's a job-hunting tool that includes mail-merge, interview tracking, and the ability to build a database of contacts.

The Resume command invokes a word processor that leads you step by step through the creation of your resume. There are specialized formats to create engineer, student, computer-specialist, and academic resumes.

A 115-page reference manual includes some good advice about preparing your resume. It talks about length ("... never more than two pages") and about including personal data ("... most experts recommend against it").

The *Resume Kit* is new, and not without some major flaws. The name and address fields, which are printed as a heading at the top of your resume, are limited to four lines of 25 characters each. And though the *Resume Kit* supports a large variety of printers, some of the printer drivers are defective.

If you want typeset-quality

resumes but lack a laser printer, the company offers a laser printing service. Send your resume on a floppy disk with \$100, and you'll receive 100 resumes, 100 matching sheets, and 100 envelopes.

List Price: *Resume Kit*, \$39.95.

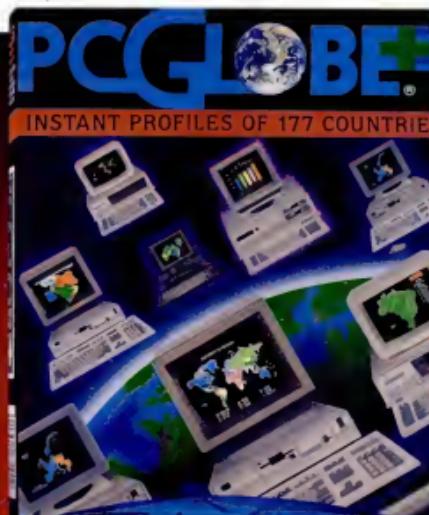


Requires: 384K RAM, 5½-inch media, printer, graphics board for preview function. Not copy protected. Spinaker Software, One Kendall Sq., Cambridge, MA 02139, (800) 826-0706.

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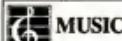
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AFTER HOURS



The CMS401 MIDI adapter, \$299 with Cakewalk software, uses Roland's chip set (see inset), so the system is compatible with the MPU-401 standard.



CMS Kit Combines MIDI Adapter with Powerful Sequencing Software

BY JONATHAN MATZKIN

MIDI connectivity is the key to a universe of bubbling synthesizers and chattering drum machines. The MIDI (musical instrument digital interface) standard allows compatible instruments to communicate, creating orchestrations of virtually unlimited complexity and variety. Adding a PC to a MIDI setup gives the musician tremendous control over his equipment and allows him to apply word processor-like techniques to composition and arranging.

Roland's industry standard MPU-401 MIDI interface for the PC has spawned a host of software packages and hardware-compatible interfaces. The CMS401 MIDI adapter, from Computer Music Supply, features Roland's chip set, so it is hardware and software compatible with the MPU-401 standard. It is also compatible with all of the software properly written to that standard. The card has MIDI in- and out-connectors, as well as a metronome connector.

For \$299, the CMS401

comes with the appropriate MIDI cables and a copy of Cakewalk 2.0, a popular sequencing software package from Twelve Tone Systems. Cakewalk is an extremely powerful and flexible sequencer. It uses a pull-down menu system and also features a graphics editing-screen that lets you use a mouse or cursor keys to insert, delete, and move notes. A flexible event-filter simplifies global editing.

List Price: CMS401 with cables and Cakewalk sequencing software, \$299. **Requires:** Half-slot, MIDI-compatible instrument; Cakewalk: 3.84K RAM, DOS 2.0 or later. Software not copy protected. Computer Music Supply, 382 N. Lemon Ave., Walnut, CA 91789; (800) 322-MIDI.

CIRCLE 693 ON READER SERVICE CARD



Home Video Producer Adds Some Hollywood Flash to Your Amateur Productions

BY DONALD B. TRIVETTE

George Lucas and Steven Spielberg, beware! Epyx Software has raised the curtain on *Home Video Producer*, a product that lets you design and animate ti-

ties and credits to give your home productions the Hollywood touch.

Using *HVP*'s menu-driven commands, you can create video strip titles and credits, frame by frame, that will be the envy of your audience. Creating titles is just as easy as selecting icons to add background color, borders, backdrops, text, and graphics. A special-effects command defines how one frame wipes, tears, scrolls, or spirals into the next frame; it links only a dissolve feature, which, according to the developer, is too slow on the PC.

The software limits each title and credit sequence to 32 frames, but since all frames must be in RAM at the same time you'll probably exhaust your memory before you reach the limit.

The program supports a total 16 colors, although none are visible on the computer monitor. The colors do appear, however, on the TV and the videotape.

If you don't feel especially creative, the software includes templates for new-baby, vacation, wedding, football, baseball, soccer, Europe, birthday, and Christmas videos. The manual gives step-by-step instructions on how to create the effect of a bunch of balloons that float onto the screen and then fly away—an especially effective animation for any birth-

day or graduation video.

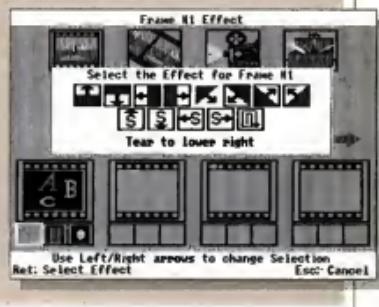
HVP works only on a computer equipped with a color graphics adapter (CGA) board with composite video output—a feature the newer EGA and VGA boards lack. Using a standard RCA cable, which you must supply, the composite output on the computer is connected to the video input jack on either a VCR or a camcorder, which is in turn hooked up to a television set. The manual has half a dozen diagrams showing different configurations.

Once the hardware is connected, you position the video tape to the place you want to record a title and pause the VCR or camcorder in record mode. Call up a video strip from *HVP* and select PlayMovie from the menu. Then release the pause button. Voilà! You've titled a film. The results won't make Ron Howard jealous, but they are more polished than a sign held in front of the camera, and *Home Video Producer* is ten times less expensive than a professional presentation program like IBM's PC *Storyboard*.

List Price: *Home Video Producer*, \$49.95. **Requires:** 256K RAM, CGA adapter with composite video output, VCR or camcorder, assorted cables, DOS 2.1 or later. Not copy protected. Epyx Software, 600 Galveston Dr., Redwood City, CA 94063; (415) 366-0606.

CIRCLE 693 ON READER SERVICE CARD

Home Video Producer offers 13 special effects for moving from one frame to the next.



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AFTER HOURS



MUSIC

Pop-up Music to Perk Up Your Spreadsheets

BY JONATHAN MATZKIN

The Ad Lib Personal Computer Music System enables even nonmusicians to express themselves in sound (see review in *After Hours*, *PC Magazine*, January 26, 1988). Its ingenious "musical spreadsheet" notation system frees users from the need to deal with traditional music symbols and provides access to a reasonably powerful FM synthesizer.

Ad Lib has released a steady stream of add-on products for the \$245 system, including a "Music Championship" game that develops ear-training skills. The latest Ad Lib add-on is *Pop-Tunes*, a \$39.95 memory-resident utility that lets you listen to Ad Lib music regardless of what else you are doing on your PC.

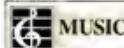
The utility can be popped up over any other program (provided there is no TSR conflict). It displays a menu of song titles and a list of options for repeat play and for playing several songs in sequence. Songs can also be programmed to begin playing at a specified time.

Pop-Tunes comes preloaded with songs. But the obvious use

for it is as a pop-up jukebox for your own sonic creations. You can, for instance, load your own music to accompany a slide presentation to be displayed on your monitor.

List Price: *Pop-Tunes*, \$39.95. **Requires:** 256K RAM, Ad Lib Music Synthesizer Card, half-slot, graphics adapter, external amplification, DOS 2.0 or later. Not copy protected. Ad Lib Inc., 50 Stanford St., #800, Boston, MA 02114; (800) 463-2686.

CIRCLE 887 ON READER SERVICE CARD



Creative Music System Offers an Inexpensive Way to Develop Your Musical Talents

BY JONATHAN MATZKIN

The \$199 Creative Music System, from PC&C Research, includes a 12-voice synthesizer (on a half-card) and a variety of software to support it. In addition to programs for playing back music, there's a utility that synchronizes music and separately generated graphics images, and another that links music with text files for a "sing-along" effect. And you can play music in the background while running another application.

You can play Ad Lib music by popping up Pop-Tunes over many applications, including word processing programs.



Turn Your PC into a Steinway

If you enjoy playing and composing on the piano, but your abode isn't large enough to accommodate a baby grand, *Pianoman* 4.0, written by *PC Magazine* contributing editor Neil J. Rubenking, may be just what you're looking for. A piano simulation program for any computer—desktop or laptop—*Pianoman* could make you the Liberace of the computer set.

The program directly supports the IBM PC keyboard, but you can run an install program to reconfigure *Pianoman* for whatever computer keyboard you have.

The *Pianoman* screen shows the keyboard layout with musical notes, instead of letters or numbers, written on each key. Sharps and flats are supported and labeled accordingly.

To create a tune, turn Record on and enter the notes from the keyboard. Your tune is stored and can be saved to disk. *Pianoman* offers a legato mode, and three different octaves are available. You can also control the duration of each note.

Pianoman lets you edit and merge the tunes you create, as well as those that are provided with the program. The editor is pretty sophisticated in its ability to perform block, copy, move, and global search-and-replace commands.

The Player Piano module lets you convert your tunes into programs that can be run independently from *Pianoman*. An optional program called SPKR lets you write up to 128 notes and then play them in background mode over another application.

—Francis P. Mitterad

List Price: *Pianoman*, \$25. **Requires:** 160K RAM, DOS 2.0 or later. Not copy protected. Support Group Inc., P.O. Box 1577, Baltimore, MD 21203; (800) USA-GROUP.

CIRCLE 888 ON READER SERVICE CARD

The Creative Music System has no MIDI capability, and it doesn't support an external keyboard. It's intended as a self-contained system for the individual PC user. It doesn't support standard musical notation, either; you enter music through a proprietary notation system that represents pitches as numbers and uses keyboard symbols to specify accidentals, note durations, and rests.

You create the notation on any editor that generates ASCII output. Then you take the word processor output and compile it using the included software. A separate program then plays back your opus.

Intelligent Organ is another separate program that lets just about anyone play something that sounds like music. There is a screen image of an organ keyboard, with its keys mapped to the keys of the PC keyboard.

You can generate only one pitch at a time from the organ keyboard, but the program adds chord accompaniment and it even has an arpeggiator.

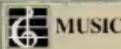
The Creative Music System is fairly powerful and feature-rich, but the documentation is weak. Aside from being written in poor English, the manuals are sparse and poorly organized. Worse yet, the system's software is divided into a number of small, focused programs that do a particular job, but there is no overall program shell to knit these features together.

List Price: Creative Music System, \$199. **Requires:** 256K RAM, half-slot, ASCII text editor, external amplification, DOS 3.0 or later. Software not copy protected. PC&C Research Corp., 32 N. Wood Rd., Camarillo, CA 93010; (800) 843-1239.

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AFTER HOURS

**Bank Street Music Writer Sparks the Creativity of Budding Composers**

BY JONATHAN MATZKIN

For years the Bank Street College of Education has lent its name and expertise to software that educates and stimulates creativity. Bank Street Music Writer, a \$149 hardware-and-software package from Mindscape, maintains this tradition as it aids budding composers in developing their musical powers.

The package consists of composition software and a half-slot add-in card that holds a six-voice synthesizer. PCjr owners can purchase the software alone (for \$49) and use their system's built-in three-voice sound chip instead of Mindscape's synth board.

Music Writer's main editing screen displays three sets of musical staves. You choose a key signature, a time signature, and

a clef from menus. Placing notes is ingeniously simple: you point with the cursor at the appropriate pitch in the musical staff and then place the note with a single keystroke. Hitting the 4 key produces a quarter note, while the 2 key places a half note. The R key generates a rest.

Music Writer's Block Transpose command lets you define and transpose sections of music. Block Copy allows you to easily repeat chunks of music without rekeying them.

That's really convenient for developing repetitive accompaniment parts. Care must be taken, however, to make sure that the target measure is wide enough to accept the material being copied. The staves don't automatically reformat themselves, so advance planning is necessary to make sure that the copied passage ends up exactly where you want it.

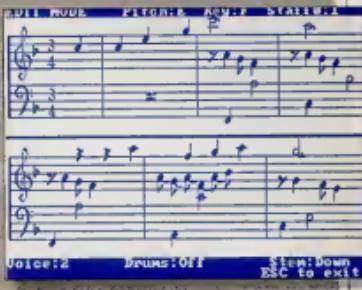
Music can be played back at any time with a touch of the F2 key, so you can hear your work in progress. You can also test a pitch before entering it by moving the cursor to a line or space of the staff and tapping P.

When playing back, Music Writer changes the color of the note currently being played, so you can *watch* as well as listen to the flow of your music. This helps in associating the sound of a particular rhythm or melody with its notation on-screen.

Music Writer outputs only to dot matrix printers; the results are attractive and readable.

The included synthesizer is rudimentary. Most of the available sounds are similar to one

Bank Street Music Writer's music editor displays staves, key signatures, and other features found in standard musical notation.



another, but they can be modified by altering the parameters that make up the sound envelope: attack, decay, peak, and release.

Music Writer has a separate screen for modifying these sounds, and a wave graphic of each sound changes dynamically to reflect the modifications. This is one of the most educational parts of the program, since it teaches some basic principles of sound generation.

Bank Street Music Writer isn't nearly powerful enough for professional musicians. There is no provision for MIDI connectivity, and you can't attach

an external keyboard to the system. But for users who want to learn about music in an unimimidating and graphically appealing environment, it does the job admirably, and at an appealingly low price.

List Price: Bank Street Music Writer, including synthesizer board, \$149. Software only, \$49.95. **Requires:** 128K RAM, CGA, half-slot, external amplification, DOS 2.0 or later. Software copy protected.

Mindscape Inc., 3444 Dandee Rd., Northbrook, IL 60062; (312) 480-7667.

CIRCLE 609 ON READER SERVICE CARD

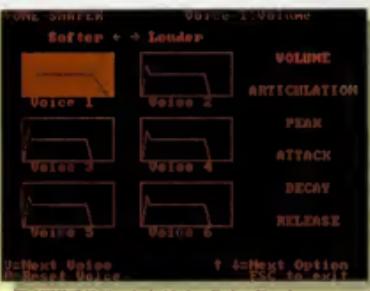
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Music, maestro, please
From PC&C Research, Ad Lib, Support Group, and Computer Music Supply: products to help soothe the savage PC.

Home Video Producer
Design and animate titles and credits for your home video.

Resume Kit
Spanaker Software's program offers help for job-seekers.

Science Toolkit
Experiments for the aspiring rocket scientist.



Among the sound parameters that can be altered are peak, attack, decay, and release. Graphs reflect the changes as they are made.

"The Dell System 220 runs most PC Labs system benchmark tests at speeds that would make you think you're running a 386."

—JOHN DICKINSON, PC MAGAZINE

"...the System 220 has more going for it than just speed"

—PC WORLD

"...includes a year's on-site support...in the price of the computer. This is the sweetest support deal offered by any computer vendor in the industry"

—ERIC KNORR, PC WORLD

"The hot item from a technical point of view is the System 220. This machine runs a 286 processor at 20 MHz, which is its major claim to fame."

—WILL FASTIE, PC WEEK

"...the Dell machine is renewed evidence that the price of 286-based desktop equipment continues to drop rapidly, making such machines very attractive for daily work under MS-DOS even as they hold out the promise of running OS/2 in the future."

—WILL FASTIE, PC WEEK

The reviews are beginning to pour in.

And they read like a wish list for every power user looking to exceed the ordinary limitations of a 286 personal computer.

The computer everyone is praising in such glowing terms is the Dell System 220.

The first 286 personal computer with a clock speed of 20 MHz.

It's totally compatible with MS-DOS and MS OS/2 and is faster than many 386 computers. Yet it sells for much less.

Because you buy it direct from us.

Eliminating the mark-ups and margins of computer stores.

We design and build every Dell computer right here in Austin, Texas.

We put each and every one through a comprehensive burn-in and a battery of diagnostic tests before we ship it.

And after we ship, we give you the best technical support you'll find anywhere in the computer industry.

Our technicians are on the phone from 7AM to 7PM every business day. Almost any question you may have about a Dell system or its software can be answered over the phone.

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Your Dell computer also comes with a thirty-day money back guarantee.

And we back every one of our computers with a one year limited warranty on any materials or workmanship.

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You'll like what we have to say.



Dell Tech Support is open from 7AM to 7PM (CST) from Monday to Friday. In most cases, our technicians can answer any question over the phone. Even if the question involves a third-party component or software program.

More fast talk from the computer industry.

